UNIVERSITY OF EXETER

DOCTORAL THESIS

Exeter from Fort to City: a faunal perspective

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Submitted by Malene L. Lauritsen to the University of Exeter as a thesis for the degree of Doctor of Philosophy in Archaeology, February 2019

I certify that all material in this thesis which is not my own work has been identified and that any material that has previously been submitted and approved for the award of a degree by this or any other University has been acknowledged.

Signature: ....

UNIVERSITY OF EXETER

Abstract

Department of Archaeology

Doctor of Philosophy

Exeter from Fort to City: a faunal perspective

by Malene L. Lauritsen

This research project investigates Roman, medieval, and post-medieval faunal material from Exeter in the South West of England. This analysis aims to examine variation over time, as well as spatial variation within the city, for example, patterns of food consumption within higher and lower status areas of Exeter, and between secular and monastic communities.

To study the variation, a range of analyses were employed, in particular, butchery analysis, fracture patterns, and metrics alongside complementary techniques such as skeletal part abundances, age profiles, and taphonomy. The analyses confirm the broad patterns identified in previous studies by Mark Maltby and Bruce Levitan and achieves a better understanding of the spatial variation and which methods are best suited to differentiate social groups.

Acknowledgements

There are many people I need to thank for helping me throughout this PhD, too many to mention, but there are some I would especially like to express my gratitude towards: first and foremost, to Alan Outram for your many years of supervising, guiding and mentoring me throughout my education – this thesis would not exist without you. Many thanks to Stephen Rippon for all your feedback and advice – I know it has not always been an easy task. For their help and advice: Emily Johnson, Tamsyn Fraser, Mark Maltby, and John Allan. A special thanks goes to my fellow PhD students for keeping me sane. Abigail Sanderson and Kelly Lake, thank you for your countless hours of proofreading and chats – I don't know what I would have done without you two. Lastly, thank you to my family for their emotional and sometimes financial support and help, and last but not least to Mark Robinson for putting up with me and for his endless support.

Contents

Abstract iii

Acknowledgements v

1 Introduction 1

Broad research questions . . . 2

Research aims . . . 4

Thesis outline . . . 5

2 Research background 9

2.1 The history and archaeology of Exeter . . . 9

2.1.1 The history of archaeology in Devon and Exeter . . . 9

2.1.2 Roman legionary fortress and *civitas* . . . 10

2.1.3 Medieval Exeter . . . 16

2.1.4 Post-medieval Exeter . . . 20

2.1.5 Faunal analyses . . . 23

2.2 Urban faunal analyses . . . 35

2.2.1 Methods . . . 36

2.2.2 Roman period . . . 39

2.2.3 Medieval period . . . 44

2.2.4 Post-medieval period . . . 50

2.2.5 Other studies . . . 52

2.2.6 Differences, similarities, and common problems . . . 56

3 Methods 59

3.1 Introduction . . . 59

3.2 Recording methodology . . . 60
3.3 Taphonomy . . . 62
3.4 Aging . . . 63
3.5 Butchery . . . 66
3.6 Fracture analysis . . . 67
3.7 Measurements . . . 69
3.8 Statistical tests . . . 71

4 The Exeter Faunal Collection 73

4.1 Introduction . . . 73
4.1.1 Phasing . . . 77
4.1.2 Site groupings . . . 77
4.2 Acorn (AC) . . . 80
4.2.1 Site description . . . 81
4.2.2 The faunal remains . . . 81
4.3 Bartholomew St. East (BSE) . . . 87
4.3.1 Site description . . . 87
4.3.2 The faunal remains . . . 88
4.4 Bartholomew Street West (BSW) . . . 102
4.4.1 Site description . . . 102
4.4.2 The faunal remains . . . 102
4.5 The Deanery (EDST) . . . 108
4.5.1 Site description . . . 108
4.5.2 The faunal remains . . . 108
4.6 Friernhay Street (FH) . . . 112
4.6.1 Site description . . . 112
4.6.2 The faunal remains . . . 113
4.7 Good Shepherd Hospital (GSH) . . . 131
4.7.1 Site description . . . 131
4.7.2 The faunal remains . . . 131
4.8 Haven Banks (HB) . . . 136

4.8.1 Site description 136

4.8.2 The faunal remains 137

4.9 Mermaid Yard (MY) 141

4.9.1 Site description 141

4.9.2 The faunal remains 142

4.10 Paul Street (PS) 158

4.10.1 Site description 158

4.10.2 The faunal remains 158

4.11 Queen Street (QS) 177

4.11.1 Site description 177

4.11.2 The faunal remains 177

5 Carcass Division **199**

5.1 Introduction 199

5.2 Roman 200

5.3 Medieval 212

5.4 Post-medieval 229

5.5 Summary 240

6 Fractures and surface modification **243**

6.1 Introduction 243

6.2 Roman 244

6.3 Medieval 248

6.4 Post-medieval 253

6.5 Summary 255

7 Livestock Management **257**

7.1 Introduction 257

7.2 Roman 258

Sex ratios 261

Size comparison 261

Discussion 262

7.3 Medieval 265
Age structures 265
Sex ratios 268
Size comparison 269
Discussion 273
7.4 Post-medieval 274
Age structures 274
Sex ratios 275
Size comparison 279
Discussion 285
7.5 Sheep/goat separation 285
7.6 Summary 288

8 From military fortress to vibrant city – continuity and change 291
8.1 Introduction 291
8.2 The Roman fortress and town 291
8.3 The medieval period 298
The high-status diet 302
The monastic diet 303
The urban industry/craft activities 305
8.4 The post-medieval period 306
The high-status diet 309
8.5 Birds 312

9 Conclusions 313
Future work 316

10 Bibliography 319

A Data collected by Maltby and Levitan 337

List of Figures

2.1 Areas bombed within the Exeter city walls . . . 11
2.2 Early Roman settlements in Devon . . . 13
2.3 The Roman legionary fortress at Exeter . . . 15
2.4 Development of the Exeter Quay . . . 21
2.5 Variation in cattle and sheep representation over time . . . 32
2.6 Map of the UK . . . 38
2.7 Overview of the relative proportions of cattle, sheep/goat, and pig from the Roman period . . . 44
2.8 Relative frequencies of cattle, pig and sheep/goat at Wroxeter baths basilica 46
2.9 Summary of the proportions of cattle, sheep/goat and pig from the medieval period . . . 49
2.10 Spatial patterning in deposition of mammal bones across medieval York . 53

4.1 Map of Exeter excavations . . . 74
4.2 Frequencies by NISP of species and groups by phase form Acorn . . . 82
4.3 Fracture history profile of phase 7 from Acorn . . . 83
4.4 Skeletal part abundances by MAU for major domesticates from phase 7 at Acorn . . . 85
4.5 Cattle butchery from phase 7 at Acorn . . . 86
4.6 Butchery on proximal cattle scapulae from phase 7 at Acorn . . . 86
4.7 Stage 4 fusion in cattle, caprines, and pigs from phase 7 at Acorn . . . 86
4.8 Frequencies of species and groups by phase form Bartholomew Street East 89
4.9 MAU absolute counts and relative frequencies of major domesticates by phase from Bartholomew Street East . . . 90
4.10 Fracture history profile by phase from Bartholomew Street East . . . 91

4.11 Skeletal part abundances for cattle by phase from Bartholomew Street East 94
4.12 Skeletal part abundances for caprines by phase from Bartholomew Street East 95
4.13 Skeletal part abundances for pig by phase from Bartholomew Street East . 96
4.14 Cattle butchery from phase 6 at Bartholomew Street East 97
4.15 Stage 4 cattle fusion by phase from Bartholomew Street East 97
4.16 Stage 4 caprine fusion by phase from Bartholomew Street East 97
4.17 Stage 4 pig fusion by phase from Bartholomew Street East 98
4.18 Fracture history profile for phase 7 from Bartholomew Street West 105
4.19 Cattle and caprine skeletal part abundances from phase 7 at Bartholomew Street West 106
4.20 Fracture history profile from the Deanery 110
4.21 Skeletal part abundances for major domesticates from the Deanery 111
4.22 Frequencies by NISP of species and groups by phase from Friernhay Street 115
4.23 MAU absolute counts and relative frequencies of major domesticates by phase from Friernhay Street 115
4.24 Fracture history profiles by phase from Friernhay Street 117
4.25 Cattle skeletal part abundances by phase from Friernhay Street 118
4.26 Caprine skeletal part abundances by phase from Friernhay Street 120
4.27 Pig skeletal part abundances by phase from Friernhay Street 122
4.28 Cattle butchery from phase 2 at Friernhay Street 123
4.29 Cattle proximal scapula butchery from phase 2 at Friernhay Street 123
4.30 Cattle skull butchery from phase 2 at Friernhay Street 123
4.31 Stage 4 cattle fusion by phase from Friernhay Street 124
4.32 Stage 4 caprine fusion by phase from Friernhay Street 124
4.33 Stage 4 pig fusion by phase from Friernhay Street 125
4.34 Phase 9 fracture history profile from Good Shepherd Hospital 133
4.35 Skeletal part abundances from Good Shepherd Hospital 134
4.36 Cattle butchery from Good Shepherd Hospital 134
4.37 Stage 4 fusion at Good Shepherd Hospital 136

4.38 Phase 10 fracture history profile from Haven Banks 138
4.39 Skeletal abundances from Haven Banks 139
4.40 Stage 4 fusion from phase 10 at Haven Banks 139
4.41 Frequencies of species and groups by phase from Mermaid Yard 144
4.42 MAU absolute counts and relative frequencies of major domesticates from Mermaid Yard 144
4.43 Fracture history profile by phase from Mermaid Yard 146
4.44 Cattle skeletal part abundances by phase from Mermaid Yard 148
4.45 Caprine skeletal part abundances by phase from Mermaid Yard 149
4.46 Pig skeletal part abundances by phase from Mermaid Yard 150
4.47 Cattle butchery from phase 2 at Mermaid Yard 152
4.48 Butchery on proximal cattle scapula from phase 2 at Mermaid Yard 153
4.49 Stage 4 cattle fusion by phase from Mermaid Yard 153
4.50 Stage 4 caprine fusion by phase from Mermaid Yard 154
4.51 Stage 4 pig fusion by phase from Mermaid Yard 154
4.52 Frequencies of species and groups by phase from Paul Street 160
4.53 MAU absolute counts and relative frequencies of major domesticates by phase from Paul Street 161
4.54 Fracture history profiles by phase from Paul Street 163
4.55 Cattle skeletal part abundances by phase from Paul Street 165
4.56 Caprines skeletal part abundances by phase from Paul Street 166
4.57 Pig skeletal part abundances by phase from Paul Street 167
4.58 Cattle butchery from phase 9 at Paul Street 168
4.59 Caprine butchery from phase 9 at Paul Street 169
4.60 Large mammal butchery from phase 9 at Paul Street 171
4.61 Medium mammal butchery from phase 9 at Paul Street 172
4.62 Stage 4 cattle fusion by phase from Paul Street 173
4.63 Stage 4 caprine fusion by phase from Paul Street 173
4.64 Stage 4 pig fusion by phase from Paul Street 173
4.65 Frequencies of species and groups by phase from Queen Street 178

4.66 MAU absolute counts and relative frequencies from Queen Street 181
4.67 Fracture history profiles by phase from Queen Street 182
4.68 Cattle skeletal part abundances by phase from Queen Street 183
4.69 Caprine skeletal part abundances by phase from Queen Street 184
4.70 Pig skeletal part abundances by phase from Queen Street 185
4.71 Cattle butchery from phase 7 at Queen Street 187
4.72 Caprine butchery from phase 7 at Queen Street 188
4.73 Caprine butchery from phase 7 at Queen Street 188
4.74 Large mammal butchery from phase 9 at Queen Street 189
4.75 Medium mammal butchery from phase 9 at Queen Street 190
4.76 Cattle butchery from phase 9 at Queen Street 191
4.77 Caprine butchery from phase 9 at Queen Street 191
4.78 Stage 4 cattle fusion by phase from Queen Street 192
4.79 Stage 4 caprine fusion by phase from Queen Street 193
4.80 Stage 4 pig fusion by phase from Queen Street 193

5.1 Cattle butchery from phase 1 204
5.2 Cattle proximal scapula butchery from phase 2 204
5.3 Cattle cranial butchery from phase 2 204
5.4 Cattle butchery from phase 2 205
5.5 Pig butchery from phase 2 205
5.6 Roman cattle skeletal part abundances 209
5.7 Roman caprine skeletal part abundances 209
5.8 Roman pig skeletal part abundances 210
5.9 North Quarter phase 6 cattle butchery 219
5.10 West Quarter phase 6 cattle butchery 220
5.11 North Quarter phase 7 cattle butchery 220
5.12 North Quarter phase 7 caprine butchery 221
5.13 West Quarter phase 7 cattle butchery 221
5.14 Nest Quarter phase 8 cattle butchery 222
5.15 Medieval cattle skeletal part abundances 223

5.16 Medieval caprine skeletal part abundances . . . 224
5.17 Medieval pig skeletal part abundances . . . 225
5.18 North Quarter phase 9 cattle butchery . . . 233
5.19 North Quarter phase 9 caprine butchery . . . 234
5.20 North Quarter phase 9 large mammal rib butchery . . . 234
5.21 North Quarter phase 9 medium mammal rib butchery . . . 235
5.22 North Quarter phase 9 large mammal vertebrae butchery . . . 236
5.23 North Quarter phase 9 medium mammal vertebrae butchery . . . 237
5.24 Medieval cattle skeletal part abundances . . . 238
5.25 Medieval caprine skeletal part abundances . . . 238
5.26 Medieval pig skeletal part abundances . . . 239

6.1 Fracture history profiles by species and phase . . . 244
6.2 Axially split bones from context 787 at Friernhay Street . . . 245
6.3 Fracture history profiles by species and phase from the North Quarter . . . 248
6.4 Fracture history profiles by species and phase from the West Quarter . . . 250
6.5 %Completeness of pig specimens . . . 251
6.6 Fracture history profiles by species and phase from the South Quarter . . . 251
6.7 Fracture history profiles by species and phase from the North Quarter . . . 254
6.8 Fracture history profiles by species and phase from the West Quarter . . . 254
6.9 Fracture history profiles by species and phase from the South Quarter . . . 254

7.1 Scatter plot of caprine pelvic measurements . . . 275
7.2 Boessneck's (1969) guide to measuring caprine metapodia . . . 287
7.3 Scatter plot of sheep/goat separation by metacarpal measurements . . . 287
7.4 Scatter plot of sheep/goat separation by metatarsal measurements . . . 287

8.1 Overall MAU of major livestock species . . . 292
8.2 Overview of fracture history profiles . . . 295
8.3 MAU from the North Quarter of major livestock species . . . 299
8.4 MAU from the Worth Quarter of major livestock species . . . 300
8.5 Turkey specimens from Paul Street excavations . . . 310

List of Tables

2.1 NISP for the four main species by period at Princesshay, Exeter 29
2.2 Number of specimens (NISP) for the late Roman phase at Princesshay, Exeter. Source: Coles 2015, Table 10.3 30
2.3 Statistics from Romano-British faunal assemblages from legionary sites and towns 33
2.4 List of sites and which historic periods the included faunal material from each location covers 36
2.5 Frequency of main domestic mammals in Roman Lincoln by century . . . 41

3.1 List of zones used for skeletal part abundances. P - proximal, S - Shaft, D - distal 61
3.2 Fusion stages for cattle, caprines, and pig. P – Proximal, D – distal. Source: Silver 1969 64
3.3 Pig tooth wear stages used in this thesis 65
3.4 Standards for log-ration analysis 70

4.1 List of phases with their corresponding time periods and date ranges . . . 77
4.2 List of Exeter faunal assemblages 78
4.3 List of sites referred to in this thesis 78
4.4 Fragment counts by phase from Acorn 81
4.5 Fragment counts of species by phase from Acorn 82
4.6 MAU absolute counts of major domesticates by phase from Acorn 82
4.7 Fragmentation counts and FFI scores for phase 7 from Acorn 83
4.8 Phase 7 taphonomy absolute counts and frequencies from Acorn 84
4.9 Summary of measurements from Acorn 85

4.10 Fragment counts by phase from Bartholomew Street East 88
4.11 Fragment counts of species by phase from Bartholomew Street East 89
4.12 MAU absolute counts of major domesticates by phase from Bartholomew Street East 89
4.13 Fragmentation counts and FFI scores by phase from Bartholomew Street East 90
4.14 Taphonomy absolute counts and frequencies by phase from Bartholomew Street East 91
4.15 Cattle tooth wear by phase from Bartholomew Street East 98
4.16 Caprine tooth wear by phase from Bartholomew Street East 98
4.17 Pig tooth wear by phase from Bartholomew Street East 98
4.18 Absolute counts of sex for major domesticates by phase form Bartholomew Street East 99
4.19 Summary of cattle measurements from Bartholomew Street East 100
4.20 Summary of caprine measurements from Bartholomew Street East 101
4.21 Fragment counts by phase from Bartholomew Street West 103
4.22 Fragment counts of species by phase from Bartholomew Street West 103
4.23 MAU absolute counts of major domesticates by phase from Bartholomew Street West 103
4.24 Fragmentation counts and FFI score from phase 7 at Bartholomew Street West 105
4.25 Taphonomy absolute counts and frequencies from phase 7 at Bartholomew Street West 105
4.26 Summary of caprine measurements from Bartholomew Street West 107
4.27 Fragment count by phase from the Deanery 109
4.28 Phase R fragment counts by species from the Deanery 109
4.29 MAU absolute counts and relative frequencies from the Deanery 109
4.30 Fragmentation counts and FFI scores from the Deanery 110
4.31 Taphonomy absolute counts and frequencies from the Deanery 110
4.32 Fragment counts by phase from Friernhay Street 114

4.33 Fragment counts of species by phase from Friernhay Street 114
4.34 MAU absolute counts and relative frequencies of major domesticates by phase from Friernhay Street 115
4.35 Fragmentation counts and FFI scores by phase from Friernhay Street . . . 116
4.36 Taphonomy absolute counts and frequencies by phase from Friernhay Street 119
4.37 Cattle tooth wear by phase from Friernhay Street 125
4.38 Caprine tooth wear by phase from Friernhay Street 126
4.39 Pig tooth wear by phase from Friernhay Street 126
4.40 Absolute counts of sex for major domesticates from Friernhay Street . . . 126
4.41 Summary of cattle measurements from Friernhay Street 127
4.42 Summary of cattle and caprine measurements from Friernhay Street . . . 128
4.43 Summary of caprine measurements from Friernhay Street 129
4.44 Summary of pig measurements from Friernhay Street 130
4.45 Fragment counts by phase from Good Shepherd Hospital 131
4.46 Fragment counts of species by phase from Good Shepherd Hospital 132
4.47 MAU absolute counts and relative frequencies of major domesticates in phase 9 from Good Shepherd Hospital 132
4.48 Phase 9 fragmentation counts and FFI score from Good Shepherd Hospital 132
4.49 Phase 9 taphonomy absolute counts and relative frequencies from Good Shepherd Hospital 132
4.50 Summary of cattle and caprine measurements from Good Shepherd Hospital 135
4.51 Fragment counts by phase from Haven Banks 137
4.52 Fragment counts of species by phase from Haven Banks 137
4.53 MAU absolute counts and relative frequencies of major domesticates by phase from Haven Banks 138
4.54 Fragmentation counts and FFI score from Haven Banks 138
4.55 Phase 10 taphonomy absolute counts and relative frequencies from Haven Banks 138
4.56 Summary of caprine measurements from Haven Banks 140
4.57 Fragment counts by phase from Mermaid Yard 142

4.58 Fragment counts of species by phase from Mermaid Yard 143
4.59 MAU absolute counts and relative frequencies of major domesticates by phase from Mermaid Yard 143
4.60 Fragmentation counts and FFI scores by phase from Mermaid Yard 145
4.61 Taphonomy absolute counts and frequencies by phase from Mermaid Yard 146
4.62 Cattle tooth wear by phase from Mermaid Yard 154
4.63 Caprine tooth wear by phase from Mermaid Yard 155
4.64 Cattle tooth wear by phase from Mermaid Yard 155
4.65 Absolute counts of sex for major domesticates by phase from Mermaid Yard 155
4.66 Summary of caprine measurements from Mermaid Yard 156
4.67 Summary of cattle and pig measurements from Mermaid Yard 157
4.68 Fragment counts by phase from Paul Street 159
4.69 Fragment counts of species by phase from Paul Street 160
4.70 MAU absolute counts and relative frequencies of major domesticates by phase from Paul Street 161
4.71 Fragmentation counts and FFI scores by phase from Paul Street 162
4.72 Taphonomy absolute counts and frequencies by phase from Paul Street . . 163
4.73 Cattle tooth wear by phase from Paul Street 174
4.74 Caprine tooth wear by phase from Paul Street 174
4.75 Pig tooth wear by phase from Paul Street 174
4.76 Absolute counts of sex for major domesticates by phase from Paul Street . 174
4.77 Summary of cattle measurements from Paul Street 175
4.78 Summary of caprine measurements from Paul Street 176
4.79 Fragment counts by phase from Queen Street 178
4.80 Fragment counts of species by phase from Queen Street 179
4.81 MAU absolute counts and relative frequencies of major domesticates by phase from Queen Street 180
4.82 Fragmentation counts and FFI scores by phase from Queen Street 181
4.83 Taphonomy absolute counts and frequencies by phase from Queen Street 181
4.84 Cattle tooth wear by phase from Queen Street 193

4.85 Caprine tooth wear by phase from Queen Street 194
4.86 Pig tooth wear by phase from Queen Street 194
4.87 Absolute counts of sex for major domesticates by phase from Queen Street 194
4.88 Summary of cattle measurements from Queen Street 195
4.89 Summary of caprine measurements from Queen Street 196
4.90 Summary of pig measurements from Queen Street 197

5.1 Phase 1 butchery 201
5.2 Phase 2 butchery 202
5.3 Phase 3 butchery 202
5.4 Phase 5 butchery 213
5.5 Phase 6 butchery 213
5.6 Phase 7 butchery 214
5.7 Phase 8 butchery 215
5.8 Proportion of butchered livestock 215
5.9 Phase 9 butchery 230
5.10 Phase 10 butchery 230

6.1 Taphonomy absolute counts and frequencies by phase 247
6.2 Taphonomy absolute counts and frequencies by phase from the North Quarter 252
6.3 Taphonomy absolute counts and frequencies by phase from the West Quarter 252
6.4 Taphonomy absolute counts and frequencies by phase from the South Quarter 252
6.5 Taphonomy absolute counts and frequencies by phase and quarter 256

7.1 Roman kill-off patterns 259
7.2 Cattle tooth wear and eruption as absolute counts from Roman phases . . 260
7.3 Caprine tooth wear and eruption as absolute counts from Roman phases . 260
7.4 Pig tooth wear and eruption as absolute counts from Roman phases 260
7.5 Absolute counts of sex for major domesticates in Roman phases 261
7.6 Cattle log-ratios and means from Roman phases 262

7.7 Caprine log-ratios and means from Roman phases 264
7.8 Pig log-ratios and means from Roman phases 264
7.9 Medieval kill-off patterns 265
7.10 Cattle tooth wear and eruption as absolute counts from medieval phases and quarters 266
7.11 Caprine tooth wear and eruption as absolute counts from medieval phases and quarters 266
7.12 Pig tooth wear and eruption as absolute counts from medieval phases and quarters 267
7.13 Absolute counts of sex for major domesticates in medieval phases and quarters 268
7.14 Phase 6 cattle log-ratios and means 270
7.15 Phase 7 cattle log-ratios and means 270
7.16 Phase 8 cattle log-ratios and means 271
7.17 Phase 6 caprine log-ratios and means 271
7.18 Phase 7 caprine log-ratios and means 272
7.19 Phase 7 caprine log-ratios and means 272
7.20 Phase 8 caprine log-ratios and means 273
7.21 Phase 7 pig log-ratios and means 273
7.22 Post-medieval kill-off patterns 276
7.23 Cattle tooth wear and eruption as absolute counts from post-medieval phases and quarters 276
7.24 Caprine tooth wear and eruption as absolute counts from post-medieval phases and quarters 277
7.25 Pig tooth wear and eruption as absolute counts from post-medieval phases and quarters 277
7.26 Absolute counts of sex for major domesticates by phase and quarter 278
7.27 Phase 9 cattle log-ratios and means 280
7.28 Phase 10 cattle log-ratios and means 280
7.29 Phase 9 caprine log-ratios and means 281

7.30 Phase 9 caprine log-ratios and means 281
7.31 Phase 10 caprine log-ratios and means 282
7.32 Summary of cattle log-ratio means 282
7.33 Summary of caprine log-ratio means 283
7.34 Summary of pig log-ratio means 284
7.35 Caprine horncore absolute counts 286

8.1 Overview of age profiles 293
8.2 Proportions of major livestock species at Princesshay 301
8.3 Overall NISP 304
8.4 Numbers and proportions of game species in the Roman period 305
8.5 Numbers and proportions of game species in the medieval and post-medieval periods 305
8.6 Summary of cattle breadth log ratios 307
8.7 Summary of caprine breadth log ratios 308
8.8 Summary of pig breadth log ratios 309
8.9 Numbers and proportions of birds in the Roman period 311
8.10 Numbers and proportions of birds in the medieval and post-medieval periods 312

A.1 Key to Maltby's (1979) phases 338
A.2 Key to Maltby's (1979) site codes 338
A.3 Summary of Maltby's (1979) Roman data 339
A.4 Summary of Maltby's (1979) medieval data, phase Md1-Md6 340
A.5 Summary of Maltby's (1979) medieval data, phase Md7-Md10 341
A.6 Summary of Maltby's (1979) post-medieval data 342
A.7 Summary of Levitan's (1989) data from St. Katherine's Priory 343
A.8 Summary of Levitan's (n.d. a) data from Exe Bridge 343
A.9 Summary of Levitan's (1989) data from St. Nicholas' Priory 343
A.10 Summary of Maltby's (1979) Levitan's (1989, n.d. a) data 344

Chapter 1

Introduction

The following thesis focusses on the Roman, medieval, and post-medieval faunal remains from Exeter with the primary topics centred around the development of butchery practices, fracture patterns, and metrics of cattle, caprines, and pigs.

Urban settlements house a large proportion of the population of any given area which has wide reaching effects, so to understand what is going on in a region or country it is key to investigate the archaeological material from the urban settlements. Urban archaeology is difficult due to the large amount of disturbance of the deposits, not to mention, we do not have access to most of the deposits as they are buried underneath occupied buildings. When excavations do happen, the deposits are often rich, yet a lot of the recovered material has not been studied, probably due to the vast quantity of the material and the time it takes to work through such an amount. The material is then stored in museums or by archaeological units waiting for researchers to take an interest in it.

Urban analyses that consider cities or large towns as a whole are few and far in between (Armour-Chelu 2003; Barber 1999; Bates 2011; Bond and O'Connor 1999; Bourdillon and Andrews 1997; Cartledge 1994; Dobney *et al.* 1995; García 2009; Hamilton-Dyer 1993; Hammon 2011; Holmes 2013; Howe and Lakin 2004; O'Connor 1984, 1988, 1991; Rowsome 2000; Wilson 2003), and when they do happen the material is often analysed on a site-to-site basis (e.g. O'Connor 1984, 1988, 1991) or as one big site Dobney *et al.* 1995, something that this thesis will try to remedy by grouping together sites with similar social contexts and/or close geographical situation. To make matters more complicated, not all cities have archaeological material that spans the Roman, medieval, and post-medieval periods which also have good excavation reports and context dating. Exeter is one of the few cities that have all of these things and in 1979 an extensive study of faunal material from the city was published by Mark Maltby, and this book remains an excellent example of urban faunal analysis (Maltby 1979).

Some studies have been undertaken since the 1979 publication (Coles 2015, *forthcoming*; Levitan 1989, n.d. a, n.d. b), however, questions posed by Maltby still remain unanswered. His medieval assemblages primarily represent high-status households from a contained area of the city while sites excavated after his analysis was completed allows us to investigate the monastic and low-status/industrial material to add contrast to past findings and shed some light on lateral variation within Exeter (Advisory Committee Report 1974, 1977, 1978, 1979, 1981, 1984, 1989; Bedford 1998; Bedford and Salvatore n.d. a, n.d. b, n.d. c; Salvatore and Simpson n.d.). Using groupings of sites to analyse lateral variation is a new method which will highlight the complexity of urban archaeological material and underline why a single excavation or grouping all sites together and treating an urban settlement as a single unit should never be done. To add further new knowledge to our understanding of past use of animal products in the diet, this research project will for the first time use fracture analysis to study marrow exploitation in historic contexts. Fracture and fragmentation analyses have only been used on prehistoric material, particularly to understand reactions to dietary stress (Outram 2001) and the Neolithic transition to milk/dairy product consumption (Johnson *et al.* 2018). Here it will be used to study the frequency with which marrow was exploited in Roman, medieval, and post-medieval Exeter and too see if the various social groups exploit marrow in different ways and last but not least, if marrow consumption is subject to major cultural shifts.

Below are the research questions and aims posed at the beginning of this PhD as well as more detailed justifications.

Broad research questions

1. What level of variation is there over time in animal representation and exploitation between contemporary sites in Exeter?

2. How do butchery practices develop in Exeter from the Roman occupation to the late 18th century?

3. Does a growing urban settlement impact the metrics of the main domesticated species?

Urban archaeological excavations typically uncover a vast amount of material, yet the majority is left unanalysed due to time and funding constraints. Exeter, like many other English settlements, is of Roman origins and therefore has deposits with a time depth of nearly 2000 years. Over the decades a large number of excavations have taken place throughout the city, both in the centre of the old town and in the outskirts. So while a typical faunal report deals with the data from a single site, and at times, a single time period, urban faunal studies have the ability to cover a great time depth as well as a large number of site types that are found within an urban context such as religious centres, industrial areas for production and preparation of goods like hides and horn cores, butchers, and of course all the areas with domestic settlement structures ranging from low to high status. Additionally, all the individual sites can be studied in relation to each other to create a detailed image of how an urban settlement with all its components forms and develops throughout the ages. A town seen through the lens of archaeology may be formed of buildings and refuse deposits, but these reflect the lives of the people that formed the settlement. Therefore, one of the most important parts of this paper is to study food as a means to understand the community and social relationships that produced it and its archaeological remains; and to do this the study of butchery methods and how they develop over time is crucial. Like the people make the town, the town is also part of a bigger landscape. The majority of the animals utilised for primary and secondary products in Exeter are likely brought in from herds in the areas surrounding the town. As Exeter grew the amount of supplies had to follow the same trend. To meet these demands the supplying farmers may have had to change the herd structures or even develop or bring in new modified lifestock better equipped for their needs. These new types or improved animals are then in turn visible to us though the analysis of measurements taking from the faunal remains. Thereby, the study of the animals from

Exeter can even tell us about the town's hinterland and its livestock farming practices.

Research aims

1. To record all unanalysed faunal assemblages from Exeter and, if time permits, re-record previously analysed assemblages.

The largest amount of unanalysed material come from over 20 sites, 11 of which will be included here. The 11 sites have been chosen specifically to add comparative and contrasting data to the previous analyses (Coles 2015, *forthcoming*; Levitan 1989, n.d. a, n.d. b; Maltby 1979) as they include material from less studied periods and social contexts. The data gathered from these will add to our understanding of the archaeology on both a site to site basis, as well as our understanding of Exeter as a whole.

2. To record the butchery evidence from each assemblage.

Splitting of the spinal column, a technique associated with professional butchers, has been observed in several urban contexts including in Exeter (Levitan n.d. b; Maltby 1979), but the earliest occurrence of it still needs further investigation. To pinpoint when and in which social context sagittal splitting and other professional/specialised techniques first occurs, butchery styles will be studied through the patterning in location and type of marks.

3. To record the types of fracture and levels of fragmentation from each assemblage.

While the study of fracture patterns is part of taphonomy, it will be analysed separately here. Both Mark Maltby and Charlotte Coles noted changing patterns in marrow extraction techniques (Maltby 1979; Coles 2015). These will be investigated to determine if new butchery techniques or cultural influences affect the exploitation of faunal resources and the consumption of bone fats. Furthermore, detailed fragmentation studies will reveal the degree of post-excavation damage in each assemblage.

4. To record taphonomic modifications to the assemblages.

The taphonomic history of the assemblages will tell us about the amount of time the refuse was exposed to scavengers and the weather (Behrensmeyer 1978; Fisher 1995; Lyman 1987, 1994). Thereby, we gain information on the organisation of refuse disposal as well as the outwards appearance of the town and possible an alternative status indicator. Furthermore, taphonomy allows us to assess the amount of information that was lost between the time of deposition and excavation and thereby form more reliable interpretations of the data.

5. To measure the long bones of the main livestock species.

Osteometric variation in cattle and sheep/goat remains can reveal sexual polymorphism which in turn tells us about farming practices and economic priorities when combined with other methods such as age profiles (Payne 1973; Popkin *et al.* 2012). Any shift in size observed in these species can then be interpreted in relation to the economy of the time and show which of the primary and secondary animal products are prioritised. Furthermore, a large number of horncores are available for this study and analysis of their shapes and sizes can tell us about separate livestock types and thereby supplement the metrics from the remainder of the cattle and sheep/goat remains.

6. To make the gathered data publicly available.

Throughout this project a large amount of data will be gathered from a range of dates and site types. As an aid to other scholars working with similar themes, all the data are made publicly available on a site to site basis though the Open Research Exeter web page.

Thesis outline

The first two chapters provide the reader with an introduction to the research undertaken and the questions asked of the faunal material which form the basis for the remainder of the thesis. It presents the background information on other studies of urban faunal material in England. Furthermore, it contains a chronological overview of the archaeological work undertaken in Exeter as well as the historical knowledge on how the city developed from a Roman fortress to a post-medieval city. Together these two chapters explains how this thesis and the questions asked of the Exeter faunal material will complement our current knowledge on Exeter and how it has developed over time.

The third and fourth chapters explain what methods have been applied during data collection and processing to answer the questions presented in the preceding chapters. The methods are then followed by a chapter on the general results of the analysis such as basic counts, preservation, element abundances, age and sex profiles. There are brief overviews of fracture patterns, butchery, and metrics, but these will be discussed further in the following three chapters.

Chapter 5 to 7 present the detailed findings of butchery marks, fracture patterns, and metrics. The butchery data is discussed in terms of how it reflects changes in society and social interactions as well as meat distribution within Exeter. Furthermore, it lays out the development of professional butchery practices in terms of methods employed in dividing up a carcass and the timeline for this development. The fracture patterns are studied and discussed to determine the shifts in how the animal bones themselves are exploited for nutrients. The chapter on metrics focusses on the physical aspects, such as size and age, of the livestock used for Exeter's meat supply which in turn tells us about the economic priorities of the farmers in the city's hinterland.

Chapter 8 takes all the information from the previous four chapters and compares and contrasts the information to map out trends across the city at different points in time. It highlights how the sites represent the various parts of urban life such as industry, crafts, domestic life, religious centres, and waste disposal, and how each these have individual signatures rather than being representative of the Exeter as a whole.

The final chapter sums up the information presented in the previous chapters and presents the final interpretations of roles and exploitation of animals in Roman, medieval and post-medieval Exeter and what this tells us about everyday urban life throughout these periods. It finishes with suggestions for future research potentials for the Exeter faunal remains and urban faunal collections in general and how they are essential in our understanding of how society has developed over the past two millennia.

The new or improved methods used in this research project can improve for the ways we approach the complex data particularly from urban contexts. The innovative way in which the sites are grouped together will prove useful to any urban analysis regardless of the studied material; the fracture analysis provides a new means to gain further insight into the use of animals products in the diet; and the way in which butchery has been recorded sets forth a new way for zooarchaeologists to delve into the finer details of butchery methods which has the potential to differentiate local and regional patterns as well tell us more about the ways meat is processed, distributed, and, consumed. Overall, the aim of this thesis is to underline how, by using simple, time efficient, and low-cost methods, we can expand upon our knowledge of something as complex as a city and how it changes over time. Research should not just be about the latest trendy method, but rather about finding ways to build comparative knowledge that can be applied and used by other researchers which, over time, will prove valuable overall to archaeology and related disciplines.

Chapter 2

Research background

2.1 The history and archaeology of Exeter

2.1.1 The history of archaeology in Devon and Exeter

An interest in Exeter and its past has been noted since the 16^{th} century by the King's Antiquary who lists the walled city as a place of antiquarian interest and by John Hooker who wrote an extensive history of the town (Bidwell 1980; Bosanko 1980). While the presence of a Roman town beneath the city appears to have been known to Hooker and other antiquarians, systematic excavations did not to take place in the county until Sir Walter Trevelyan began work at Kent's Cavern, Torquay in 1824. These excavations led to the formation of the Torquay Natural History Society, as well as the creation of a museum to hold and display the large amounts of material collected from the caves. In the 1960s, an investigation of barrows in the Devon landscape was undertaken by the newly formed Devonshire Association. The professed objectives of the Association were 'for the advancement of science, literature and art' and historical and archaeological studies were coming to forefront already in the early days, especially work on barrows and the antiquities of Dartmoor. Increased popular interest in archaeology in the 1920s resulted in the formation of the Devon Archaeological Exploration Society which lead important work such as the excavations of the Roman Baths in Exeter and Hembury Fort in the 1930s. Interest in early coins from the area was ongoing and the increased interest in archaeological and antiquarian studies spurred on more detailed studies, hypotheses and estimations of construction periods and the people of Roman Exeter (Crotchet 1902; Haverfield and Macdonald 1907; Milne 1948; Shortt 1936). There appears to have been a surge in historical studies as well, the majority of which took available archaeological material into consideration. Furthermore, scholars studied documentary sources about the development of the city, how it was connected to events in the rest of the country and the impact of maritime trade (Coate 1928; Lewis 1924; Lewis and Shorter 1939; Shorter 1954). The Royal Albert Memorial Museum put on two exhibitions of the city archives, one in 1953 and another in 1962, to draw attention to the rich history of the city and allow its citizens to engage with original documents such as court rolls, maps, books of sentences, letters etc. (Royal Albert Memorial Museum). Bombings during the Second World War badly damaged two large areas within the city walls (Figure 2.1) providing an opportunity to examine the foundations of the city. Responsibility for archaeology in Exeter was given to the newly formed Excavation Committee for War-Damaged Exeter with Lady Aileen Fox as the Director of Excavations. The archaeological work undertaken from 1945 to 1947 resulted in a large published report on the recordings of the first full-scale professionally directed excavations in the city and became the foundation for much of the later work in Exeter (Bidwell 1980; Bosanko 1980; Fox 1952).

Much of the more recent work in Exeter has been done through the Exeter City Museum Archaeological Unit, which was established in 1971, and has led to publications such as *The Legionary Bath-House and Basilica and Forum in Exeter* (Bidwell 1979);*Faunal Studies on Urban Sites: The Animal Bones from Exeter, 1971-5* (Maltby 1979); and books on the Roman, medieval and post-medieval finds (Allan 1984; Holbrook and Bidwell 1991).

2.1.2 Roman legionary fortress and *civitas*

In AD 43 the Roman Empire launched an invasion of Britain and within five years much of southern Britain was within their control (Todd 2001, 9; Todd 1987, 192). By AD 49 the newcomers were exploiting mineral deposits in the Mendip Hills of Somerset and readying to take over the Dumnonii territories in modern day Devon and Cornwall. As part of this invasion the main strike-force, the Second Augustan Legion, was stationed at the Roman fortress of *Isca* at Exeter, sometime between AD 50 and AD 55, though a date up to AD 60 is possible. The military occupation continued until after AD 70 when the Roman attention turned towards the final conquest of Wales and northern Britain (Todd 2001).

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FIGURE 2.1: Areas bombed within the Exeter city walls. Source: Fox 1952 Plate I

The location the Second Augustan Legion chose for their fortress was a strategically well placed raised area with its close proximity to a navigable river surrounded by highland areas restricting access routes to the fortress and at the same time making the entrance points visible from the riverside location (Lewis and Shorter 1939; Bidwell 1979).

Due to the extent of the Second World War bombings, it was not possible to excavate in all bombed areas and the two zones east and west of the Cathedral within the Roman Wall became the focus points (Figure 2.1). While much more information has been gained in later years, Fox's overall interpretation of the occupation phases is still quite reliable.

Lady Fox divided the Roman occupation into three settlement phases: Phase I AD 50/55 – AD75/80, Phase II AD 80-200, and Phase III AD 200 onwards (Fox 1952, 7, 17, 21). The architectural remains of the first phase in the upper part of the town, i.e. west of the cathedral, were scattered suggesting a 'straggling settlement', although remains in the South Street area are suggestive of comparatively more intense settlement with huts, hearths, post holes, a narrow road and some rectangular timber houses. Based on the identified structures and their associated finds, Fox concluded that the early settlement was of a civilian nature, as nothing was found to suggest the presence of military. In later years, substantial evidence to the contrary was uncovered and is described below. All of the buildings Fox excavated appeared to have been built directly on the natural soil and rock with no evidence of occupation in the area prior to the arrival of the Romans (Fox 1952). However, evidence from the 1970s, 1980s and 2000s disputes the lack of prior settlers after the discovery of a possible prehistoric ring-ditch, two hut-circles underneath one of the early Roman structures and small quantities of prehistoric lithics and a small Iron Age roundhouse (Holbrook and Bidwell 1991; Steinmetzer et al. forthcoming), as well as more extensive Neolithic and Bronze Age features and finds on the outskirts of modern day Exeter (Quinnell and Farnell 2016).

In the second settlement phase from AD 80-200 the wooden buildings were systematically dismantled and in the South Street area the ground surface evened out with a clay layer with drainage channels and then covered by a thick layer of clean river gravel which was surfaced by small cobbles (Fox 1952). Part of the gravelled area remained throughout the remainder of the Roman occupation. On the eastern side of this open space a large masonry structure was constructed, presumed to be the forum based on its dimensions and architectural features, as well as some other stone structures and possible remains of baths on the eastern side of modern South Street near the Deanery (Figure 2.3, section 4.5). In the upper part of the town no buildings could be assigned to this phase, but there were two rubbish pits, a cobbled courtyard and a wide metalled road. The Roman bank surrounding the settlement was estimated to have been constructed in the 2nd century backing the city wall and possibly predating it as some of the foundations of the wall cut through the bank. The construction of the wall itself could not be precisely dated, but some associated pottery suggests a date range in the third occupation phase. This last phase of the Roman settlement from AD 200 onwards also saw some rebuilding of some of the public buildings and construction of houses with mosaic floors. The end of 4th century saw the public buildings and outside areas fall out of use in what was likely the ending of the Roman occupation (Fox 1952).

After the publication of Fox's book, a possible signal-station, likely to be from the first century, was discovered on Stoke Hill approximately 2.5 km north of the centre of

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FIGURE 2.2: Early Roman settlements in Devon. Source: Maxfield 1999, Map 10.1

the Roman settlement (Bidwell 1979). The hill-top grants views, on a clear day, from the mouth of the Exe estuary to the Blackdown Hills. While no buildings were discovered at the site, there were two layers of defences: an outer ditch and rampart with another enclosure in the centre also surrounded by a ditch and rampart (Bidwell 1979). Another Roman site in the vicinity of Exeter is located on the eastern bank of the estuary south of the city at Topsham. Roman finds had been discovered at this site which has been dated to AD 50/55 – AD 70-75 and interpreted by some as a possible port or supply-base (Bidwell 1979, 1980a; Fox 1952; Shorter 1954), though recent discoveries of military defences suggests that it was a fort or fortlet (Sage and Allan 2004).

More information was gained on the nature of the early Roman occupation in Exeter after further excavations in 1964 and the early 1970s which lead to Paul Bidwell's publications in 1979 and 1980 (Bidwell 1979, 1980a) and Chris Henderson's paper on the Roman walls in 1984 (Henderson 1984). Combined with the Steinmetzer *et al.* forthcoming paper on the Princesshay excavations in the centre of Exeter, these publications give us the most up-to-date information on the overall chronology of Roman occupation. In North Tawton, Alverdiscott and Tiverton camp sites, likely related to military units on the march, suggest that the fortress at Exeter was used as a base for the conquest of the remainder of Devon and Cornwall. In addition, a considerable number of early Roman sites in Devon show that there were military networks across the county aiding in the initial takeover of the area (Bidwell 1980b; Figure 2.2).

During the excavations in 1964 and 1970s part of a military ditch, timber barracks of legionary size and part of a *fabrica* were uncovered along with a substantial bath-house and its associated buildings and features of which the latter appear to have been reduced in size with the departure of the Second Augustan Legion in AD 75 (Bidwell 1979; Figure 2.3). As the baths were made smaller they became incorporated into the newly constructed *basilica* south-west of the *forum*. The defences of the fortress included both an inner and an outer ditch which would have been visible until the early 3^{rd} century when they were filled in completely and new buildings were constructed (Henderson 1999, 484). The ditch encircled an earth and timber rampart which was left standing after the departure of the legion (Henderson 1984). These defences were maintained for a short period and then served as a boundary around the town after it achieved *civitas* capital status around AD 80. With its new status the settlement gained some degree of self-government within the Roman Empire the area thereby becoming *Isca Dumnoniorum*. The town retained the fortress defences until the 2^{nd} or early 3^{rd} century when the Roman wall was constructed to encompass a greater area allowing for the growth of the town (see Figure 4.1; Henderson 1984, 1999; Bidwell 1980b; Steinmetzer *et al.* forthcoming). Reports on specific findings relating to the Roman fortress can be found online through the Archaeological Data Service archives (Exeter Archaeology Archive Project).

The founding of Exeter is important in the archaeology and history of the South West because the settlement becomes the first urban centre in the region (Todd 2001). At the start of the 2^{nd} century the development spreads beyond the fortress circuit and industrial and craft areas continued to grow in the St Sidwell's area and by the bank of the river Exe while the centre of the town was the heart of the administrative, commercial and legal workings controlling the Dumnonii territories.

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FIGURE 2.3: The Roman legionary fortress at Exeter. Source: Bidwell 1980a, Fig. 7

The end of the Roman occupation is likely to have started with the breakdown in central power elsewhere in the Empire. From AD 360 onwards smaller and smaller quantities of coins reach Exeter and by AD 380 they had almost completely stopped and the local industries appear to have come to an end by the early 5^{th} century (Todd 1987, 234). What happened to the Roman population is not known in any detail, but there does appear to have been continued settlement in the town (Crabtree 2018; Fox 1971, 16; Pearce 1978, 42). The lack of pottery and metalwork in the archaeological record make dating incredibly difficult. There is some evidence that people continued to live within the walls of Exeter at least until the early 5^{th} century. Radiocarbon dates of burials in the Cathedral Close suggest that some of the burials are from the late 5^{th} century (Higham 2008, 77). The Roman burials were previously located away from the main settled areas and outside of the defensive circuit. That burials are now being found in the centre of the settlement suggests a radically altered community and attitude to the treatment of the dead, which may be associated with the existence of a Christian community. As these burials are on the site of the later Saxon minster and Norman Cathedral makes it possible that there is a continuous Christian occupation of the centre of Exeter (Todd 2001).

2.1.3 Medieval Exeter

After the end of the Roman rule in Britain and the decline of *Isca Dumnoniorum* at the turn of the 5^{th} century, the following seven centuries in Devon are still rather obscure. As Britain, and thereby the South West, was gradually isolated from the economic, military, and political influences of the Roman Empire, town life became harder to maintain as trading routes changed or disappeared though sporadic trade does continue with the Mediterranean in other areas of the South West (Pearce 1981, 166). Bartering for commodities slowly replaced the use of coinage in the countryside and mass-produced Roman pottery changed to locally made vessels of wood and leather (Burrow 1980). These two replacements drastically reduce the datable materials in the archaeological record resulting in much vaguer interpretations of the recovered material. In the first centuries after the end of the Roman period, the Romanized councils were substituted for monarchy under the Kingdom of Wessex. Anglo-Saxon settlers gradually took over the South

West during the 7^{th}, 8^{th} and 9^{th} centuries and Devon is first mentioned as a shire in AD 851 (Burrow 1980; Higham 2008, 5; Pearce 1981, 177; Todd 1987, 269). The study of place-names indicates that they completely took over the South West, but that it was a gradual occupation. Many of the interactions between the natives and the newcomers are unlikely to have been of a violent nature but it did result in a series of battles in the 7^{th} and 8^{th} centuries (Higham 2008; Todd 1987, 270).

Once Devon was included in the Kingdom of Wessex and the townscapes were once again growing in the region, the Vikings started their raids in the first half of the 9^{th} century (Burrow 1980; Gore 2015; Higham 2008). The many sheltered anchorages along the shores meant that it was an ideal area for the Vikings to attack the Anglo-Saxons in the Kingdom of Wessex. Exeter itself became a significant location in the continued strife when the Viking army moved from Wareham to Exeter in AD 876 where it took over at least part the city and made use of the Roman fortifications until an agreement was made with King Alfred of Wessex and they moved to Gloucester in Mercia in AD 877 (Gore 2001). According to an early 12^{th} century writer, William of Malmesbury, Æthelstan was the one who fortified Exeter with walls and towers in the late Saxon period. This may or may not be accurate, but a survey of the walls show that improvements were indeed made in this period and charters issued from the town show that Æthelstan held at least two councils in Exeter, so he would have had reason to see the town well defended. Nonetheless, it was taken by a Viking army in 1003 which caused considerable damage. At this time Exeter would have been quite a wealthy town as it had the fifth highest output of minted coins in England by around AD 980 and was likely the centre for processing and export of Dartmoor tin in this period. It seems as if some Scandinavians settled in the town as one of the churches in the city centre is dedicated to the Norwegian St. Olave and was granted land by the King's mother between 1057 and 1065; it also received a grant from Edward the Confessor in 1063. Furthermore, a significant number of the names of the moneyers that produced coins on the King's behalf in Exeter and Devon were Scandinavian. While this is not proof of a permanent Scandinavian community in Exeter as moneyers are specialists that move around, it does show they were there for at least a short period of time. The peace that settled when the Scandinavian kings held the

English throne lasted until the Norman Conquest when the mother and possibly some of the sons of King Harold II held Exeter against William the Conqueror. This led to an 18-day siege in the winter of 1068 before the new ruler took over the town (Gore 2001). This was the beginning of a slow and steady growth until the 13th century, at which stage in its development Exeter was noted to have "a bishop and a palace, a lord and a castle [. . .] a mayor and a guildhall" (Freeman in Lewis and Shorter 1939).

This development may have been helped along by the Norman Conquest and the Normans' encouragement of trade which allowed foreign merchants to profit from wool, tin and leather being traded through Exeter and by 1068 records refer to a great number of foreigners in the city (Lewis 1924). During the 13th century Exeter lost its prominent position in tin exportation and saw more and more competition from other port towns and cloth manufacturers which was likely due to the town's comparatively low wealth and population numbers compared to other towns in England (Kowaleski 1995; Youings 1969). However, it still had a large number of foreign traders and by the first half of the 14th century became the head port of England's largest customs jurisdiction and, in 1326, it was one of the country's nine wool centres. While its wool industry recovered quite quickly after the plague in the mid-14th century, trade stagnated in the first half of the 15th century only to see a dramatic increase in the both the cloth export and maritime trade in the 1440s. The success continued for the rest of the century and was accompanied by the population numbers more than doubling over the next two centuries of increasing prosperity (Kowaleski 1995; Youings 1969).

The archaeological material from the first few centuries of the medieval period is, as mentioned above, scarce. Fox encountered some in the post-war excavations when the foundations of St George's church were uncovered at South Street. A 19th-century drawing of the building before it was demolished in 1843 showed how it looked at the end of its life and the excavations provided information on its original construction in the 10th century. Some of the building materials were reused from Roman ruins and the remainder were made of the local trap (a lava stone which occurs naturally at Rougemont). The addition of a large 15th-century tower shows that the church was likely to have been in use throughout the medieval period. The dating of the structure is mainly based on architectural features and construction methods (Fox 1952). Similarly, St Mary Major, which stood at the front of the Cathedral, had its origins before the Norman Conquest and excavations revealed that the church had been constructed on a late Roman cemetery (Henderson and Bidwell 1982). It is likely to be the church adopted by Leofric, the first bishop of Exeter, in 1050 and was used until the Cathedral was ready in 1133 (Barlow et al. 1972; Swanton 1980). As mentioned previously, a survey of the Roman Wall showed that repairs were made in the late Saxon period and the discovery of a small lane put down in the 9^{th} century running along inside the fortifications on the South-East side which may have been to service the defences. The examined area behind the Wall had 11^{th}-century ridge and furrow ploughing and was sparsely populated until tenements were laid out in the 13^{th} century. Other sites in this half of the walled area were absent of evidence for late Saxon occupation so the area occupied by the Saxons is likely to be in the centre of the area near the modern day cathedral where the churches and cemetery were (Gore 2001). Analysis of the finds from the excavations between 1971 and 1980 tell the same story. There were no artefacts dated to before 9^{th} century to suggest a settled area beyond the religious community in the Cathedral Close. The Guildhall sites located about 150-175 metres north-west of the cathedral contain the majority of the $10^{th}/11^{th}$ centuries finds indicating that this was the most densely settled area of the Saxon period (Allan 1984).

The beginning development of the Quay and the first Exe Bridge around 1200 gives some indication of the growing prosperity and trade networks of the town following the Norman Conquest (Henderson 1991). The end of the 12^{th} century also saw the construction of a lead pipeline or conduit to allow fresh water to flow from outside the city wall to the Cathedral Close which was extended in 1226 to supply a well in the lower part of the city once again suggesting the growth of the town (Exeter archive site 56 and 77; Stoyle 2014). The standing city walls also provide testament to the growing wealth of the town. There is only little evidence for repairs or improvements before the Conquest, but in the time following William the Conqueror's capture of the town in 1068 the construction of the castle began and the walls saw constant improvement and maintenance. By the 14^{th} century, semi-circular towers had been added to the circuit, several of them around the castle and the East and South Gates were extended or rebuilt in the start of the 16^{th} century accompanied by a considerable length of wall being rebuilt on the south-west side of the circuit (Blaylock 1995). The vast majority of the excavations in Exeter have uncovered material from the medieval period, though unfortunately as earlier research was primarily focused on the Roman occupation, both medieval and post-medieval occupation phases are mainly noted to have disturbed the Roman layers underneath. Nonetheless, many of the finds lists are available through the Archaeological Data Service archives online. The advisory committee reports that were written for the Exeter Archaeology Unit give overviews of the findings in each year from 1971 to 1997, including descriptions of the archaeology of each of the settlement phases of the individual excavated sites, are also all available online through the Exeter Archaeology Archive Project section of the Archaeological Data Service website.

2.1.4 Post-medieval Exeter

Devon was one of the most prosperous counties in the country during the reign of Elizabeth I and Exeter was the religious, economic and political centre of the county with the merchants' trade having greatly expanded by the end of the 16^{th} century (Gray 2001). In John Hooker's description of Exeter written at the end of the 16^{th} century, he notes that the town had four principal industries: farming, cloth-making, tin-extraction and maritime enterprises which all produced commodities that could be exported and have been part of the trade going in and out of the town since the Norman Conquest. At this time the tin production was in decline and while the county suffered from harvest failures in the 1580s and 1590s Hooker still believed the farming to be the most significant industry of the four main ones. The farms usually practiced mixed farming with both crops and livestock and the wide variety of geographical environments in the region ensured a mixed variety of produce from fields, orchards and backyards. The most common livestock were cattle, sheep and pigs, but their meat did not occur frequently in the general diet and when it did it could even include parts like pigs' feet and cows' udders. Of the domesticated birds, geese, ducks and chickens, the most predominant species was geese at they could be raised cheaply on grass. More unusually, wild birds

FIGURE 2.4: Development of the Exeter Quay. Source: Henderson 1991, Fig. 12

such as rooks, blackbirds and seagulls would make their way to the dinner table. Of the edible secondary products, the county, like today, excelled in making clotted cream and also made two types of cheese with a high fat content. The last of the four industries was cloth production which greatly contributed to the maritime trade. The woollen industry slowly started after the Norman Conquest as trade in wool, which grows into one based on cloth manufacture by the 16^{th} century. It grew to such a scale the wool had to be imported. While there were no factories used at this time the scale of it ensured employment for a large number of people both in Exeter itself as well as in the small market towns, villages and farmsteads in the surrounding region as each place focussed on a different part of the cloth making process. These fabrics were primarily sold to the London market or sent directly overseas, primarily to northern France (Gray 2001). Despite a depression in foreign trade in the 1620s and the almost total disruption of port activities during the Civil War in the 1640s, the cloth trade picked up again in the 1670s and resulted in the Exeter Canal being deepened to allow ships weighing over 200 tons to reach the Quay to easily transport the large amount of goods being traded in and out of Exeter (Henderson 1991). While the Civil War caused an almost total disruption of the Quay's activities, there was still an overall increase in prosperity over the 17^{th} century which may have been the main driving force behind the increase in the population which was estimated to at least 9,000 in 1641 increasing to a minimum of 10,500 in 1660 (Stephens 1958, 40, 145). How the Civil War and the sieges on Exeter affected these numbers is unknown, but from 1642 to 1646 the county was torn apart and thousands lost their lives (Stoyle 2001).

In terms of archaeology, the development of Exeter from the early 15^{th} century to the later 18^{th} century can be seen in the evolution of the Quay where there is approximately four meters of deposits documenting a sequence of successive quays and warehouse foundations (Henderson 1991; Figure 2.4). The Elizabethan quay was built in 1564-7 and multiple improvements and extensions happened over the next 50 years. The rapid growth of the woollen manufacturing industry in the 17^{th} century saw further improvements to the quay and Exeter Canal which included the construction of the Custom House that still stands today. The improvements to the Canal included extensions and a deepening of the Canal allowing ships up to 200 tons to travel all the way up to the Quay instead of mooring further downstream and transporting the goods up to the town by lighter vessels. The final developments were made in 1770s when the Quay was extended even further downstream to the length that can be seen today (Henderson 1991).

2.1.5 Faunal analyses

So far, approximately 46 excavations in Exeter have produced faunal material ranging from a few to several thousand fragments. About half of these assemblages have been analysed since the start of archaeological excavations in the city, with the majority of the analysed material being examined and by Mark Maltby in the 1970s and Bruce Levitan in the 1980s (Levitan 1989, n.d. a, n.d. b; Maltby 1979) and more recent work as been undertaken by Charlotte Coles on the faunal material from the Princesshay excavations in the eastern area of the city centre. While Maltby's works is available in *The Animal Bones from Exeter 1971-1975* (Maltby 1979), the majority of other analyses have not been completed or published yet.

The book Lady Aileen Fox wrote on Roman Exeter after the excavations in the late 1940s contained a small section written by a Dr. F.C. Fraser on the animal remains of Roman and medieval Exeter recovered from South Street and Catherine Street (Fox 1952, 95). The samples he analysed contained large amounts of very fragmentary material, which he suggested could be a result of long bones broken for marrow. With the exception of a fish bone and a medieval caudal vertebra from an immature porpoise (*Phocaena phocaena*), all the identifiable specimens from South Street were from domestic species. Goat is not mentioned in his analysis, but that may be due to difficulties in securely identifying this species; however, cattle, pig, sheep, horse and dog were present, though horse only as a single tooth and an astragalus and dog is similarly poorly represented. Cattle are the most abundant species, presumably by fragment count. When possible, measurements were taken and compared to those from skeletons at the British Museum. There is no mention of which elements were measured or what breeds they were compared to, but the cattle, sheep and pigs were at all times smaller than the modern skeletons. The only exception was an immature cattle metacarpal which was of 'considerably greater size' than any of the other archaeological specimens (Fox 1952, 95).

The next person to examine Exeter faunal material was Mark Maltby who analysed 75,000 fragments and published the findings in a single report, which has become a great example of the potential of urban zooarchaeology and it is to date the most comprehensive analysis of the Exeter faunal collections (Maltby 1979). The analysed material was recovered from nine sites excavated between 1971 and 1975 (Appendix A), seven of them located within the Roman city walls and the remaining two just outside the walls near the South gate. The aims were to review the methods applied by zooarchaeologists to urban material and to provide information about a fundamental aspect of life in the Roman legionary base and *civitas*, and medieval Exeter and life in the thriving market town. To understand how animal remains can teach us about the everyday lives of the inhabitants, Maltby asked a series of questions: 'What was their diet? Did they supplement their meat supplies with hunting and fowling expeditions? Did a person's prosperity or status in society influence his diet? How was the domestic stock slaughtered, butchered and marketed? Were cattle most important for beef, their hides, dairy products or as working animals? Were sheep bred principally for meet or wool or milk or cheese?' (Maltby 1979, 1). The answers were sought using standard zooarchaeological methods such as species identification, estimations of minimum number of individuals (MNI), statistical tests as well as recordings of age indicators, metrics and butchery marks for cattle, sheep/goat and pigs. Using these methods, Maltby was able to see variations in overall species representation including changing trends in relative frequencies of the main livestock species over time i.e. cattle, sheep/goat and pig. These trends became visible by running the data through chi-squared tests which showed that during the Roman and medieval periods the sheep/goat and pig frequencies stayed relatively stable while the cattle numbers changed significantly. However, it was suggested that there is a lot of variation within the Roman samples so the results may not be representative of the overall patterns of the Roman period in Exeter. The tests on the medieval and post-medieval assemblages showed that they were so different that not a single one of the post-medieval samples were statistically similar to the medieval ones particularly for the sheep/goat samples.

As cattle are the most frequent species they are ideal for identifying varying patterns in element representation, butchery patterns and metrics. A comparison of the metrics taken from various elements showed no evidence for stock improvements during the Roman and medieval periods. While the data from 1500-1700 are in the upper range of measurements from the two previous periods more data have to be collected to show any statistically significant trends (Maltby 1979, Figure 8 and 9). The smallest animals were the average size of Iron Age cattle and the largest were similar to modern Shorthorns. However, the majority of animals in Exeter were smaller than those found at other sites in England dating to the Roman and medieval periods. The same trends are apparent in calculations and comparisons of withers heights. Concentrations of cattle skull and jaw fragments in features from the 1^{st} and 4^{th} centuries suggest that at least some of the animals were brought to areas dedicated to primary butchery. It is likely that cuts of meat were then distributed or sold throughout the Roman settlement. Similar concentrations were not found in any of the medieval deposits, though some pits had unusually high proportions of these elements – they were still consistently lower than any of the Roman deposits. The majority of these pits are from a small area of the town. In terms of butchery, the majority of the marks were found on meat bearing long bones followed by metapodia. The major meat bearing bones were usually severed laterally in several places which has been interpreted as evidence for marrow removal or that cuts of meat were sold or distributed rather than filleting the meat of the bones. The metapodia had frequently been severed laterally across the shaft in all three periods. The numbers of proximal and distal metapodial epiphyses were usually equal in the deposits, however, proximal ends occur in concentrations with skull and jaw fragments indicating that they often were discarded early in the butchery process while the corresponding distal ends must have been transported elsewhere and used for some purpose that remove them from the archaeological record. The clearest sign that butchery methods developed over time is the evidence for sagittal splitting of the vertebral column which is present from the 16^{th} century onwards but uncommon in Exeter before the post-medieval period, after which it became an established practice. This practice seems to have been accompanied by a decline in skull fragments from both cattle and sheep. Aging profiles for sheep/goat provide clear evidence for the impact of the successful wool trade described above. During the Roman and medieval periods there was a high mortality rate of immature animals with a peak in slaughter between 15 and 30 months. In the later medieval period the peak is at the higher end of the age range and many animals were allowed to reach full maturity. Once mature, the animals were likely to have produced several fleeces of wool.

As mentioned above, Maltby wanted to determine if a person's prosperity or social status had any influence on his diet. The pottery data available to him had not given any indication of major differences in social status in the deposits dating earlier than the 16^{th} century in any of the nine sites he investigated. Imported vessels and fine jugs occurred in similar quantities in all areas of the excavations in question. This increases the importance of investigating status as reflected in diet and the presence of species associated with the upper echelons of society. However, in the 1970s, when this study was made, it was not well known which species were good indicators of high status dining which is why the low numbers of red deer, roe deer, hare, etc. while noted as present, were not viewed as playing an important role in the diet. Now, these species, along with rabbit, fallow deer and other wild species are recognised as uncommon or expensive foods, particularly after the Norman Conquest when access to wild animals were restricted by law, unlike in the Roman times when the animals were not considered to be the property of anyone (Sykes 2007). Therefore, Maltby is likely to have identified deposits from households of different status, but simply was not aware of it at the time.

Mark Maltby's work remains the only major published analysis of the faunal remains from Exeter, though in the 1980s Bruce Levitan investigated several other sites and was able to publish the results of a few, while others exist as unpublished reports or interim reports for the Ancient Monuments Laboratory (Levitan 1987, 1989; Levitan n.d. a and b). In Levitan's chapter on medieval animal husbandry in the English South West he uses two Exeter sites, Exe Bridge just outside the Roman City Wall which had large deposits of horn cores likely from a hornworker and St. Katherine's Priory located approximately 1.5 miles outside the City Wall, for a detailed comparison to illustrate the variation present between faunal assemblages from urban settlements. The data from these sites explain why generalised statements cannot be made about economy and husbandry as the settlements are highly complex and each site within an urban context needs to be analysed on both an individual basis and then subsequently as part of a larger pattern (Levitan 1987). He puts his point across in a comparison of the proportions of cattle, sheep and pigs at two sites, St. Katherine's priory and Exe Bridge highlighting how site function can affect the faunal signature(Appendix A). At the priory cattle represents around 30% of fragments of the three species in the 13^{th} century which increases to 48% by the end of the 15^{th} century. The opposite happens at Exe Bridge where cattle starts at 50% in the 13^{th} century but the frequency fall to around 36% by the end of the 16^{th} century. A further contrast is seen in the main taxa. At the priory, sheep/goat makes up around half the assemblage, whereas, at Exe Bridge it is cattle that represents about half the identifiable fragments. Clearly, there can be a lot of variation between contemporary sites in relatively close proximity to each other and these differences will need to be considered and analysed further to gain the most information possible from the archaeological material available to us. The Exe Bridge assemblage is distinctive in its own right. Unlike all the other Exeter sites analysed to date it has a very high number of 13^{th} century horn cores which is likely to be the refuse from a specialised horn processing site in the vicinity of the Exe River (Levitan n.d. a).

At some stage in the 1980s Levitan also analysed the faunal material from the Roman phases of eight sites to complement, contrast and clarify the findings of Mark Maltby (Levitan n.d. b). The data that Levitan collected from the eight sites are available as raw data on a printed copy; however, the analysis of the data is only available as a preliminary small report with no tables and graphs. While Maltby's analysis considered a wider range of material and a larger overall assemblage, not much Roman material was available to him so he only included certain features that he felt were worthwhile following up on when other sites were analysed in later years. Due to the more comprehensive analysis done by Maltby on metrical analysis, butchery and statistical tests of lateral variation, these have not been included in Levitan's analysis and instead he focussed on species quantification, anatomical zone representation and age at death. These three aspects of his analysis showed that little change occurred in the exploitation of the major taxa between the military and civilian phases. However, there are some indications of variation in disposal methods of primary butchery waste where there is good evidence of organised disposal into the old military defensive ditch by the end of the 2^{nd} century. In terms of shifts in the age profiles between the two occupation phases, the age at death for cattle does not appear to change at these sites. For sheep/goat there seem to be a higher proportion of younger animals in the civil phase while pig, on the other hand, seems to have higher proportions of more mature animals in the civilian phase. These findings were compared to a 1984 survey by Anthony King comparing the cattle, sheep/goat and pig percentages from Roman military and civilian sites in Britain, Gaul and Germany. He found that there is considerable overlap in the patterns from the two settlement types but that military sites have relatively higher proportions of cattle and pigs as opposed to the civilian sites where sheep/goat were more important. However, Levitan states that the Exeter Roman military sites do not follow this pattern as cattle are not particularly well represented, whereas the civil phase material fits better with King's findings (Levitan n.d. b). The raw data from these Exeter sites will need to be further explored in future analysis and compared to each other as well as to a wider range of sites to explore the level of variation that can be found within contemporary sites in a single settlement.

The most recent analysis of Exeter faunal material has been done by Charlotte Coles and is part of a larger project on the Roman and medieval levels of the Princesshay excavations that were undertaken between 1997 and 2006 (Coles 2015; Steinmetzer *et al.* forthcoming). The site is outside the boundaries of the military fortress but largely within the walls of the Roman *civitas*. The project examines parts of the defensive ditches and the interval towers of the military as well as a series of enclosures and streets from the Early Roman civil occupation that had extensive evidence for tile production and lastly the later town houses from the 3^{rd} and 4^{th} centuries. A total of 6657 fragments could be dated to any one of the three broad periods: military occupation (AD 50-75), the early town (AD 75-200) or the later town (AD 200-400). Only 106 fragments belong to the military phase and they are in poor condition so only 26 were identifiable to species and it is therefore difficult to draw any conclusions about the earliest Roman occupation. This

TABLE 2.1: Number of specimens (NISP) for the four main species by period at Princesshay, Exeter. Source: Coles 2015, Table 10.2

Phase	Cattle	% NISP	S/G	% NISP	Pig	% NISP	Chicken	% NISP	Total NISP
Military	11	52%	6	29%	3	14%	1	5%	21
Early Town	199	48%	110	26%	84	20%	25	6%	418
Late Town	322	37%	173	20%	134	16%	230	27%	859
Total	532	41%	289	22%	221	17%	256	20%	1298

assemblage and the details given on each of the phases as well as on the bones from an unusual pit feature are a great example of why the assemblages from each excavation should be analysed both on an individual basis and as part of a bigger picture. Table 2.1 shows the NISP for cattle, sheep/goat, pig and chicken as well as the percentage of the total NISP for each of the taxa by phase. Keeping in mind that the total number of fragments for the military phase is very small, the general pattern for cattle and sheep/goat is a steady decrease in their relative frequencies over time. Pig sees an increase from the military to the early town phase followed by a decrease in relative numbers in the late town phase. Chicken is present as 5% and 6% of the total NISP in the two first phases but then jumps to 27% in the late town phase making it the second most frequent species after cattle. However, the numbers for the Late Town phase look considerably different in Table 2.2 where they are given both with and without the contents of pit 4880. The pit contained nearly half of the identifiable fragments from the phase and has a rich collection of bird bones and a relatively low percentage of cattle. Out of the main four species in this feature, cattle make up 10%, sheep/goat 13%, pig 24% and chicken has the highest relative frequency with 53% of the 401 identified specimens. If the assemblage from the late town phase excluding pit 4880 is used to consider changes in the presence of these domesticates, cattle appear to become much more frequent and see a drastic increase in frequency whereas the sheep/goat stays at 26% like in the early town phase. The pig specimens drop from 20% to 8% in the later phase, whereas chicken appears to occur in the same relative numbers as in the previous two Roman phases. Furthermore, the age at death for pigs in the late Roman town is different in the pit feature and elsewhere. In the pit young animals around 2-4 months old are found, whereas the individuals in the remainder of the late town assemblage are older with ages around 25-30 months.

TABLE 2.2: Number of specimens (NISP) for the late Roman phase at Princesshay, Exeter. Source: Coles 2015, Table 10.3

Phase	Cattle	% NISP	S/G	% NISP	Pig	% NISP	Chicken	% NISP	Total NISP
Late Town minus 4880	280	61%	120	26%	36	8%	22	5%	458
Pit 4880	42	10%	53	13%	98	24%	208	53%	401
Total	322	37%	173	20%	134	16%	230	27%	859

In addition to all the standard methods of analysis used in the previous faunal studies in the city, Coles incorporates some additional metrics for sex estimation of cattle and more detailed sexing of domestic fowl. She recorded the presence and absence of spurs on the fowl as well as medullary bone. This type of bone is formed in female birds during laying season allowing for a more accurate estimation of sex ratios for the fowl population. Coles compares her overall findings with those of Maltby and a more recent study of mammalian bones at Roman sites by Anthony King (1999). King's findings show that cattle become increasingly more dominant in the later phases of Roman towns. Looking at Table 2.1 this is not the case with the Princesshay material, but in Table 2.2, where pit 4880 has been excluded, cattle make up the vast majority of the identified fragments. Three of the sites analysed by Mark Maltby show a similar trend with 48% cattle in the early town and then 71% in the 3^{rd} and 4^{th} centuries. It is still unknown why the assemblage from pit 4880 is so different from any of the other Roman animal collections but it is argued that it is probably of a much higher status that the other Princesshay material due to the large quantities of pork and unusually high numbers of birds. Coles makes special notice to the overall changing pattern in cattle bone fragmentation. Shattering of bone appears to have been commonplace in the early town material but occurs much less frequently in the 3^{rd} and 4^{th} centuries. Coles interprets this as an indication of a change in the practice of marrow extraction (Coles 2015).

Following up on Levitan's plea for more inter-site comparison, Appendix A lists the available absolute and proportional data from 12 of the Exeter sites that were analysed by Maltby and Levitan. Each of the sites provided new information with no replication of the exact patterns from any of the other sites or the Roman and medieval data from Princesshay shown in Table 2.1 and in Table 8.1. The data show clear variation between contemporary sites in all phases and even ones in very close proximity to each other. For example, the Goldsmith Street and Trickhay Street sites lie within 20 metres of each other. In the contexts dating to 1300-1350 (phase Md9) cattle frequencies vary between 19% and 46%, sheep/goat between 35% and 47%, pig between 9% and 20% and the overall amount of bird specimens vary between 8% and 21%. There is clearly a large range of factors affecting what species end up in the same context and there is not a single answer for how the assemblages were formed. Using simple fragment counts will only tell us so much and more detailed analyses of the assemblages are required to explain how there can be such a great disparity between deposits and, furthermore, what these differences can tell us about urban life. The analysed assemblages dating to 1300-1350 are comparatively small so the numbers may not be completely representative of the original archaeological deposits, however, it only highlights why more data are needed to provide more reliable information.

When the data from each phase/time bracket is added together to give an overall view of the frequencies of cattle, sheep/goat, pig and bird, the image still remains complex, but some tentative general trends can be seen. From the Roman military occupation to the first few decades of the civilian town, cattle became much more frequent while the other taxa occurred in relatively lower numbers. The frequency of cattle then seemed to fade and especially pig started to be present in much higher numbers and was once again as frequent as it was during the military phase. During the medieval period the relative cattle frequency remained fairly stable between 30% and 40%, whereas sheep/goat occurred in either the same or higher numbers than cattle while the pig and bird remains take up the remaining 20%-30% and retained quite stable numbers throughout this period. With the start of the post-medieval period around 1500, cattle once again represented about half of the faunal material while sheep/goat remains occurred less often than expected despite the wool trade becoming increasingly more successful at this time and more sheep related products made their way to town. Nonetheless, it is possible that only the wool made its way to Exeter and that mutton took longer to become the most frequently occurring meat in the diet. By the end of the 18^{th} century sheep/goat make up about half the identifiable specimens whereas cattle make up about a third. During the post-medieval period the overall amount of bird remains vary the most, ranging from

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FIGURE 2.5: Variation over time in the representation of cattle and sheep shown in relative percentages. Source: Sykes 2006, Fig. 5.1

9% to 34% over this 300-year timespan. However, looking at the data from the individual sites it is clear that the variation across the period is a reflection of the even greater differences between the sites which vary between 3,5% and 58%. An investigation of the specific avian species is needed to deduce what causes these dissimilarities.

Ignoring the great differences between sites and phases and only looking at the overall patterns for the Roman, medieval and post-medieval periods, birds steadily increase in numbers over time in opposition to pig which sees a decrease over time. In both the Roman and the post-medieval periods cattle made up around half the overall numbers followed by sheep/goat with about a quarter to a third. Only in the medieval period was sheep/goat more frequent than cattle, yet only with about a 2% margin and they both represent roughly 40% of the total of the identifiable faunal remains.

Comparing the Exeter Roman data with statistics gathered by Anthony King (1999) on Roman legionary sites and civilian towns it is clear that there are both similarities and differences between the Exeter assemblages and the averages from other British sites (Table 2.3). The numbers for the town phase are a good match with the Exeter data only differing from the general average by a few percent - which is still easily within the standard deviations. The data from the military phase are, however, not within the British average except for pig. Cattle are over 20% less frequent than the average legionary site and sheep/goat about 15% more frequent meaning that these amounts are not within the standard deviation. However, the standard deviations in Table 2.3 are so great that the they are more of a reflection of highly variable proportions found in these Roman

TABLE 2.3: Statistics from Romano-British faunal assemblages from legionary sites and towns, numbers are percentage means with standard deviation (King 1999, Table 3) and the averages from the Roman Exeter sites (Maltby 1987; Levitan unpublished data

	Legionary sites	Towns	Exeter Roman fortress (AD 55-75)	Exeter civilian occupation
Cattle	65,3 ± 16,8	53,5 ± 18,5	43,92%	49,93%
Sheep/goat	14,9 ± 11,2	27,0 ± 14,0	31,31%	27,85%
Pig	21,6 ± 11,0	19,5 ± 9,8	24,77%	22,22%

settlements rather than closely defined brackets saying that sites outside of these deviations are anomalies. Therefore, having some of the Exeter proportions lying outside the standard deviations is not necessarily a sign that something unusual is going on.

Throughout the medieval period the relative frequencies of cattle and sheep/goat shift, going from cattle being the dominant around the time of the Norman Conquest to sheep/goat taking over some time during the 12^{th} century until the turn of the 13^{th} century. Over the next two centuries the numbers balance out and the species occur in equal numbers. In Naomi Sykes'(2006) study of the variations in cattle and sheep/goat numbers throughout the medieval period shifts are identified and presented in Figure 2.5. Unlike the Roman material, the proportions of at least some of the medieval faunal remains are similar to the national average. Unfortunately, it is difficult to compare the patterns from the post-medieval period in Exeter to other English urban faunal data as most studies often do not include the material from this period and currently there are very few comparative studies available. Some data are available for post-medieval Lincoln and the numbers are almost identical to the overall ones obtained from the Exeter assemblages. At Lincoln, cattle made up 55% of the assemblage, sheep/goat 36% and pig 9% and in Exeter the proportions are 55% cattle, 37% sheep/goat and 8% pig (Dobney *et al.* 1995, Table 10 and 11). Further comparisons of the age and butchery evidence is needed to determine if the similarities continue throughout the assemblages.

While a large quantity of the Exeter faunal material has been analysed, there are still questions to be asked and answered and new sites have produced assemblages that can give us new information that will add to our current knowledge of the animals in and around Exeter. For example, another large collection of horn cores was recovered and when examined it can potentially provide us with information on cattle types and proportions of sheep and goats, which are otherwise difficult to attain. As this particular collection is likely to represent a specialist trade such as horn core working, the cores could also reveal if there were any selection of specific shapes and sizes of horns and if these are different from other specimens recovered from other contexts across the city. Mark Maltby specifically calls for further investigation of the faunal assemblages to better understand the process of slaughter and marketing of meat (Maltby 1979, 87). This statement is followed by a note to a thesis on how agricultural systems respond to increasing numbers of people in a population that is not directly related to food production and how the demand of an urban population can be a major stimulus to agricultural change. These relationships between faunal remains and how they tell us about links between Exeter and its region will need to be investigated when more data have been collected from a larger range of sites across the city and we have a better understanding of how livestock reflect the inner workings of the urban population before we try to understand how growing population numbers impact the agricultural practices. Part of this process is to determine how many sites or how much data will need to be analysed before we start seeing repetitions and thereby can be fairly certain that we have the best possible understanding of how Exeter has developed and what level of intra-site variation we can expect to find in other urban contexts. As part of the extensive investigation of the faunal material it will be determined what happens on a site to site basis over time and then the findings will be compared laterally across the city to determine what is going at any given time; how the different areas of Exeter develop and change; and where industries and craft workings are located and if these practices have changed as the city develops.

As seen in Appendix A, neither Maltby or Levitan analysed any material from the period between the end of the Roman occupation until the turn of the first millennium AD. Therefore, the large quantity of unanalysed material will need to be examined to locate any evidence from this already poorly understood period of English history. Furthermore, as mentioned above, both Maltby and Coles have pointed out possible shifts in fragmentation patterns between settlement phases which might be linked to shifts in the exploitation of faunal resources such as marrow (e.g. Maltby 1979, 39; Steinmetzer et al.

forthcoming). Therefore, any future analysis should take fracture analysis into consideration and aim to understand when and why these shifts occured and how they might be related to other changing patterns in faunal exploitation. Some of the unpublished data Levitan collected needs to be compared laterally across Exeter, as well as to Maltby's data. Furthermore, in the analysis of the eight unpublished sites Levitan focussed on the Roman phases, so the medieval and post-medieval material still remains unanalysed. The data should to be made publicly available and any of the unfinished analyses should be fully examined and included in the comparison of sites across Exeter. Analysing the full collection of animal bones from Exeter and making the data available to the wider research community will enable other researchers to identify specific assemblages that are relevant to their own projects and thereby aid the ongoing zooarchaeological research of urban material.

2.2 Urban faunal analyses

As in Exeter, the historical and archaeological background of a number of other English towns and cities have been studied and include data from the associated faunal assemblages. The following section reviews a range of published sources on faunal material from multi-period sites in England. The sites included in this review are listed in Table 2.4 along with the time periods that the faunal material covers, the locations of the towns and cities can be seen in Figure 2.6. It should be noted that in London material has been recovered from each of the periods, but the reports are highly dispersed. Therefore, the capital has only been included as an example, but the primary focus will be on other large urban settlements in England. At the end of the sections for the Roman and medieval periods there are summary graphs for the NISP data presented (Figure 2.7 and 2.9). However, London has been omitted from the summary of the Roman material due to the scarcity of the data included here; similarly, the material from Oxford has not been included in the graph for the medieval period as there is no information on the cattle.

Due to the quantity of studies and the vast amount of information obtained from urban assemblages from English sites, the evidence included in the following sections will be focussed on data relevant in the understanding and future analysis of the faunal

TABLE 2.4: List of sites and which historic periods the included faunal material from each location covers. Sources: Barber 1999; Bates 2011; Bourdillon and Andrews 1997; Cartledge 1994; Dobney *et al.* 1995; García 2009; Hammon 2011; Holmes 2013; Howe and Lakin 2004; Mulville 2009; O'Connor 1984, 1988, 1989, 1991; Pitt 2006; Rielly 2001; Rowsome 2000; Swift 2001; Wilson 2003

Site	Roman period	Medieval periods	Post-medieval period
Bath	X		
Chester		X	
Lincoln	X	X	X
London	X		
Norwich		X	
Oxford		X	
Southampton		X	X
Wallingford		X	
Wroxeter	X	X	
York	X	X	X

material from Exeter, therefore the primary foci are basic counts, age data, and butchery information from material dated to the Roman, medieval and post-medieval periods. To aid the reader there will be seven sections in this chapter: general methods applied in the excavation and analysis of urban faunal material; separate sections for each of the three relevant historical periods; useful studies that have not been included under the historical periods; significant similarities and differences between the different sites; and lastly the main issues that are likely to arise during the study of urban material.

2.2.1 Methods

The vast majority of urban excavations are due to imminent construction work that will damage or destroy the archaeological material in the ground below. During the building boom in the 1960's and 70's, large areas in the centres of major English cities received planning permission and fortunately archaeologists were in most cases allowed on site prior to construction to recover as much archaeological material as possible. However, in most cases, the excavations were subject to considerable time constraints, so the methods applied had to be efficient. Hence, at the majority of sites, only a few select soils samples were elected for sieving. This creates a bias in the faunal assemblages towards large fragments primarily representing of the main livestock species, with the small mammals, fish, birds, and amphibians likely to be vastly underrepresented. None the less, the samples that have been sieved provide a good indication of what material may have been lost in other unsieved contexts, and depending on sample selection, it is possible to get some indications of what unsieved contexts may have contained.

As most urban faunal assemblages cover a range of periods and contexts the questions asked of them in the post-excavation analysis are mainly broad and tailored to get a basic understanding of the changes in economy over time and between the various excavated areas. Furthermore, they usually aim to provide a data collection that is easily comparable with other faunal analyses e.g. NISP, MNI, relative proportions of cattle, sheep/goat, and pig, etc. A good example encompassing the majority of such questions comes from the publication on the Lincoln faunal assemblages. The aims/questions are as follows:

1. *The extent of settlement in Lincoln and its suburbs through time, and the development of major foci;*
2. *The study of spatial patterning within the city and its suburbs, where questions of particular interest are related to the provisioning of the city during different periods; the extent of socio-economic variation through time; and evidence of commerce, crafts and industries;*
3. *The examination of Lincoln's hinterland and its trading contacts, and the way in which changes in their extent and shape are related to the fortunes of the town.*

Dobney *et al.* 1995, 15

To answer these questions a range of methods are applied. These include: full species lists, including birds, fish and amphibians when relevant; calculations of livestock ratios by period, site and/or context; evidence of butchery and whether there are any patterns suggestive of primary or secondary butchery or craft activities such as tool making; and metric data taken for indications of livestock sizes and types. These are only the basic methods that are generally applied, there are variations and preferences between each analysist and much is dependent on the quantity and quality of the material studied.

FIGURE 2.6: Map of the UK with locations of town and cities mentioned in this thesis. Source: Adapted from www.mapsofworld.com

2.2.2 Roman period

The Roman occupation in England starts in AD 43 and ends in the early 5^{th} century. Following AD 43 Roman fortresses are built on either uninhabited strategic sites or in the vicinity of British settlements; many of these military sites are catalysts for urban growth forming the basis of English towns and cities existing today such as Exeter, London and York. However, as Roman settlements are typically much smaller in size than the towns and cities today, not all excavations will cover areas with Roman material. Furthermore, due to the age of the material and the recovery from densely settled areas with nearly two millennia of human activity affecting it, some of the assemblages are in very poor condition and are often not representative of the original Roman deposits. The information below will primarily be from larger assemblages that are well preserved.

In London, the excavations at 1 Poultry provided at large collection of Roman material recovered from wet soil conditions that ensured that they were extremely well preserved. While the majority of the assemblage have been recovered by hand during the excavations, over 1000 soil samples were washed through nylon mesh providing a large range of faunal material that includes very small species such as young eel (*Anguilla anguilla*) which are otherwise rarely recovered (Rowsome 2000, 8). Unfortunately, the publication available about this site is tailored towards the general public and therefore does not include many details on what the assemblage contains, though it is mentioned that analysis of soil samples from backyards reveal that pigs, chickens and possibly other animals were kept in the yards and outbuildings (Rowsome 2000, 30). The excavations at Newgate, Bishopsgate and Cripplegate are not much help either, as the excavations only provided a few hundred fragments each, and as they cover approximately 350 years of Roman history very little detailed information can be gained from them (Howe and Lakin 2004; Pitt 2006; Swift 2001). The faunal material from the London Bridge excavations at Fennings Warf only shed marginally more light on the use of animals in Roman London. A total of 592 fragments were recovered from the early and late Roman periods with 201 of these being late Roman eel bones. While the numbers are too low to draw any detailed conclusions from, is does give indications of the proportions of the main species. It appears as if pig is the most common of the three main livestock in the early Roman phase with very little sheep/goat. Nonetheless, if cattle sized fragments are included in the cattle fragment counts this species may be as frequent as pig. In the late Roman phase these relative proportions changed and cattle fragments are by far the most frequent followed by sheep/goat and pig now being the least well represented though still occurring in significant numbers. Chicken also provided part of the diet with 35 fragments identified, 25 of these in the late Roman phase (Rielly 2001, Table 9 and 10).

At the Bath Street excavations in Bath the dating is good enough to separate the Roman material into three phases with respectively 663, 987 and 1263 identified fragments. Over 60% of these fragments have been identified to medium or large mammal leaving only a rather small number to be identified to specific species in each phase so the data should be used with care. In all three phases, both in terms of fragment counts and MNI, sheep/goat are the most frequent species, pig and cattle have almost equal MNIs in the two latter phases, though in the first phase pig have an MNI of 24 to 16 for cattle and almost three times the number of fragments. However, cattle have considerably higher fragment counts for the two other phases so it is difficult to determine which of these species had the higher representation at the time of deposition (Barber 1999, Table XXVIII, p. 109-110). Only a small number of bones could be used for age-at-death assessment but those available from sheep/goat indicate ages between 6 and 48 months; the cattle all appear to be over four years old and the pigs between 4 and 17 months old. The age estimations are all based on tooth eruption and wear as well as epiphyseal fusion for cattle (Barber 1999, p. 109-110).

The excavations in Lincoln were much more fortunate in the recovery of Roman faunal material and the assemblages have been subject to a more detailed analysis compared to the London and Bath material. The Lincoln Roman assemblage covers approximately three and a half centuries of occupation ending in the very last part of the 4^{th} century AD. The major domesticates make up between 80% and 96% of the assemblages throughout the period with the remainder being represented by wild species, the minor domesticates (horse, dog and cat) and domestic birds (chicken and goose). The minor domesticates have their highest frequency during the 1^{st} century when the Roman fortress was first

TABLE 2.5: Frequency of main domestic mammals by NISP in Roman Lincoln by century. Adapted from Dobney et al. (1995), Table 11.

Species	1st century	2nd century	3rd century	4th century
Cattle	61%	71%	50%	79%
Sheep/goat	25%	18%	38%	13%
Pig	14%	11%	13%	7%

established, whereas the domestic birds are at their most frequent stage in the 3^{rd} century. Wild species are either completely absent from the assemblages or occur in very low numbers (Dobney *et al.* 1995, 21). There are variations in the relative proportions of the main domesticates in each century but cattle fragments are always the most frequent followed by sheep/goat and lastly pig (Table 2.5). The two major Roman faunal assemblages dating to the $3^{rd}/4^{th}$ centuries both have a comparatively low frequency of the major meat bearing bones from cattle and sheep but high numbers of head, teeth and mandible fragments along with lower front limb elements and metatarsals. Pig does not occur in high numbers in any of the analysed assemblages but, overall, there appears to be higher numbers of mandibles and radius/ulnae with slightly lower values for scapulae, humeri and tibiae (Dobney *et al.* 1995, Figure 12,13, 18, 19, 23 and 24). These patterns suggest that the sheep/goat and cattle bones are primary butchery waste and the pig remains are more likely to be from food consumption as there are barely any metapodia or phalanges. Similarly, in the material from Bath, the cattle are all over four years old with most of them likely to be over eight in the 4^{th} century assemblage. The fusion data contrast slightly with this as it suggests that most were between 4 and 5 years of age (Dobney *et al.* 1995, 30). Unfortunately, no data for ages are given for sheep/goat and pig, but based on the provided graphs the majority of sheep in the 4^{th} century reached adulthood (Dobney *et al.* 1995, Figure 52b).

Besides the relative proportions, element representation and age-at-death data, the assemblages contained information on carcass processing, though mainly on cattle bones from the 4^{th} century waterfront assemblage. The butchery marks on the fragments indicate a systematic approach to dividing up the carcass into smaller joints by chopping through the articulations of the major front and hind leg bones and at the horns. The long bones were then at some later stage chopped and split longitudinally which has been interpreted at evidence for marrow extraction. Furthermore, scapulae from a number of assemblages showed trimming around the glenoid cavity, removal of the spine, a perforation of the blade, and nicks and shaving marks from a blade indicating curing of shoulder joints by brining and/or smoking (Dobney *et al.* 1995, 24-27, Plate 3 and 4, Figure 27a-l).

In the 2^{nd} century faunal material from the General Accident site in York similar evidence was identified for curing of shoulders of beef as well as marrow extraction and cattle and goat horncore processing on a commercial scale (O'Connor 1988, 117, 118). This site also indicates a high reliance on cattle; however, unlike Lincoln, the relative frequencies of pig and sheep/goat fragments at this site are almost the same (O'Connor 1988, 75). Only little information could be gained on the element representation, butchery practices and age-at death, but curing of beef shoulder joints seems to have been quite common and no evidence of cattle aged under 3 years has been found (O'Connor 1988, 81-82, 86).

At another site in York, Skeldergate, the bones from a Roman well highlights how different assemblages from a single settlement can tell us about a range of activities, so rather than getting a general idea of the use of animals in a specific period or face, we can get a higher resolution image of daily life. Over 70% of the identifiable fragments were from cattle that were almost all over four years old and a partial dog skeleton makes up for the majority of the remaining number of identifiable specimens as well as a small number from sheep, pig, cat and brown hare. The cattle fragments do not represent the various parts of a carcass equally, rather horncores, mandibles, scapulae and pelvis fragments occur in high numbers and limb bones and vertebrae in low numbers. This pattern has been interpreted as primary slaughter waste as opposed to what one would find, for example, in a pit with food waste (O'Connor 1984, 15).

The General Accident Site assemblage is the largest one from the Roman period in York, and it provides us with a lot of information on commercial aspects of animal use in certain parts of the settlement which needs to be kept in mind when looking at the relative proportions of the major domesticates. The numbers will tell us about the preference or availability of material for craft activities such as horncore processing and hide tanning but it does not allow for any wider interpretations on the diet of the Romans. This is why knowing the type of material and what aspect of urban life it represents is highly important when comparing assemblages and the relative frequencies of species, age-at-death data, etc. as they may not be comparable. For example, there are variations between the frequencies of sheep/goat and pig in Lincoln and York, but until we know what activities the assemblages represent we cannot be sure that the differences are representative of the whole settlement.

The assemblages from the four cities above all cover different aspects of how animals represent life in the Roman period, however, due to the format of the sources and what aspects of daily life the material reflects they are complex to compare and it is difficult to draw any reliable general interpretations about husbandry practices in England during this period. Nonetheless, based on the information above, cattle appear to have the most well represented species at all times making up on average 60-70% of the assemblages, sheep/goat and pig make up most of the remaining percent but with the former usually having higher numbers than pig (Figure 2.7). However, the Bath material suggests that there can be considerable variation in ratios between sites or assemblages. There is not a lot of data available on age-at-death and butchery patterns for sheep/goat and pig, but due to the higher numbers of cattle elements we know that these were, with few exceptions, over four years old when they died and then the carcasses were divided into joints by separating limbs at their major articulations.

The patterns in livestock use in England show some variation in overall trends, at least under the assumption that the sites above are representative of general national trends; however, the discrepancies between the average values and sites such as Bath Street, whether these are a bias from a small sample site or not, serve as a reminder that there can be considerable differences and each site should be analysed as an individual case and not as a part of an average if we want to know more about life and approaches to farming practices in the hinterlands of urban settlements. Furthermore, while the sites included here are not the only multi-period urban sites, only a limited number of these sites have Roman material in any quantity. Even the sites included here leave gaps in

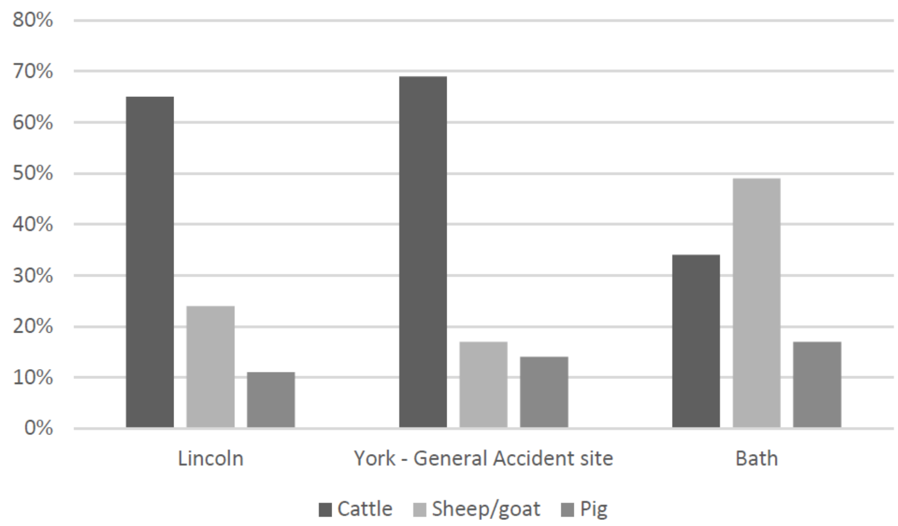

FIGURE 2.7: Overview of the relative proportions of cattle, sheep/goat, and pig by NISP from the Roman period. Source: Barber 1999, Table XXVIII; Dobney et al. 1995, Table 11; O'Connor 1988, Table 18

our knowledge of faunal material from the period such as butchery methods and age-at-death profiles for sheep/goat. The Roman period has both a military and civilian phase, but so far there is limited information on the effects of this transition and how the faunal profiles differ on either side of the shift and what it says about the changes in population, lifestyle, and settlement purpose.

2.2.3 Medieval period

The medieval period is subdivided in to three phases, but depending on the geographical part of England and its history of invasions, the specific site and personal preference of the author writing up the faunal reports, the phases have different names such as Anglo-Saxon and Anglo-Scandinavian for phases of the early medieval period and Anglo-Norman for part of the high medieval period. Here they will be mainly be referred to as the early, high and late medieval periods, the first of which lasts from the 5^{th} century to the Norman Conquest in 1066 and heralds the start of the high medieval period. The second lasts from 1066 until the end of the 13^{th} century and the late medieval period lasts from the end of the 13^{th} century until the end of the 15^{th} century, or in some cases the very early part of the 16^{th} century.

The Wroxeter faunal material covers the transition from the late Roman to the early medieval period which spans from the early 5^{th} century to the 6^{th}-7^{th} centuries (Hammon 2011). The assemblage consists of 23,201 identifiable fragments divided between seven settlement phases of the baths *basilica* (Figure 2.8). Looking at the relative proportions of cattle, pig and sheep/goat in Figure 2.8, it seems highly likely that the low NISP for Phase T-V and Phase X create a different pattern to the other five phases with much higher NISPs. These two phases have significantly lower representations of cattle and much higher numbers of sheep/goat than any of the other phases; however, taking the values for Phase W it seems likely that at least the proportions of sheep/goat fragments were higher prior to the late 5^{th} to the late 6^{th} centuries. There seems to be a drastic drop in sheep/goat in Phase X-Y coinciding with a marked increase in cattle. The proportions in the last three phases are almost identical; they shown a slight drop in cattle representation an increase in sheep/goat and pig. The shift in proportions is also evident in the butchery practices and element representation. General butchery practices remain the same as the ones described for the Roman period, but now occur with increased marks suggestive of filleting meat from the bone, and there is a greater deposition of upper limb elements (Hammon 2011, 294, Fig. 4). Data on cattle mortality indicate that almost all individuals survived into adulthood suggesting that husbandry practices remained the same throughout the study period (Hammon 2011, Fig. 5).

In York over 75,000 fragments were recovered from the early medieval period at the Coppergate excavations with the largest groups of them analysed. The 5^{th} century to the mid-9^{th} century saw no signs of occupation at the site, so the material cannot be compared to Wroxeter, but it does cover mid-9^{th} century to the later 11^{th} century. The numbers given for relative proportions have been calculated to include the full assemblage rather than just the main livestock species for the period, though only 6.6% is taken up by the minor domesticates, fish and birds, cattle make up 59%, sheep/goat 21.7% and pig 12.1% which indicates very little difference between the Wroxeter and Coppergate values (Figure 2.9), despite the 150-year difference, and similarities are evident in the butchery data as well (O'Connor 1989, 154-155, Table 40). The cattle age data provided for Coppergate show that about two-thirds were younger than five to six years old and the remaining

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FIGURE 2.8: Relative frequencies of cattle, pig and sheep/goat by NISP at Wroxeter baths basilica. Phase T-V: late 3^{rd}-4^{th} century; Phase W: late 4^{th} to mid-5^{th} c.; Phase X: late 5^{th} to mid-6^{th} c.; Phase X-Y: late 5^{th} to late 6^{th} c.; Phase Y: early 6^{th} to late 6^{th} c.; Phase Y-Z: early 6^{th} to late 7^{th} c.; Phase Z: early 6^{th} to late 7^{th} c. Source: Hammon 2011, Table 1, Fig 2.

third were mostly under eight years old which also corresponds to the patterns at Wroxeter (O'Connor 1989, 161). Similarly, the vast majority of sheep/goat from across York survive into adulthood (Bond and O'Connor 1999, Table 92). At the Fishergate site in York relative proportions are also given for the full faunal assemblage for the 8^{th} to the 9^{th} century and the proportions are 60.9% for cattle, 25.1% for sheep/goat and 9.5% for pig which once again show very little variation from the two other sites (O'Connor 1991, Table 59). The early medieval period in Lincoln is nearly identical with respectively 58%, 25% and 11%. Southampton, however, differs with approximately 80% cattle, 15% pig and about 5% sheep/goat (Bates 2011, 223; Dobney *et al.* 1995, Table 9). Yet, according to another source, at the Six Dials excavations in Southampton the relative frequencies are 53.5% for cattle, 32.1% for sheep/goat and 14.4% for pig, and while these numbers are still different from the Wroxeter and York data they are not drastically so (Bourdillon and Andrews 1997, 244). The analysis of material from several different sites in Oxford show that the combined proportions of sheep and pig range from 78% to 31% between the 10^{th} and 13^{th} centuries so there is clearly room for great variation in the relative proportions in some towns (Wilson 2003, Table 7.21). In terms of butchery patterns and element representation all faunal material studied from Hamwic (Anglo-Saxon Southampton) appears to be kitchen rather than primary butchery waste. The recorded marks on the bones do not show any obvious patterns as they are in a range of places and in multiple different directions (Bourdillon and Andrews 1997, 244-245). Another collection of material that stands out is from the Saxon occupation of Chester. 3346 fragments from five separate excavations were identified as being from one of the main species, cattle make up 71.5% of the assemblage, sheep/goat 7% and pig 21.5% (Cartledge 1994, Table 12.2). Based on element representation, four of the five analysed assemblages appear to be domestic refuse, whereas the remaining assemblage has a high ration of horncores and metapodia which is suggestive of industrial waste (Cartledge 1994, 109).

Moving further into the medieval period to the time following the Norman Conquest, M. Holmes (2013) performed an analysis on the Wallingford faunal material comparing contemporary assemblages from different parts of the town to see if the procurement of different types of meat or raw materials and if it can reveal new insights into the economy and status of the people living within particular areas of the town. The analysis showed clear divisions in the proportions of the main domestic mammals with the castle area having greater proportion of sheep and pig than sites within the town and its suburbs. Furthermore, the small amount of available mortality data indicate that younger animals were more likely to be found at the castle as opposed to the other areas where the cattle and sheep were mature (Holmes 2013, 369-370, Figure 9.17).

The Coppergate faunal material shows that a gradual shift in the livestock proportions from the mid-9th to the 13th century. The earliest material has 69.2% cattle, 18.2% sheep and 7% pig. Each of these values have a fairly gradual shift over the study period with cattle frequencies decreasing to 47.9%, sheep increasing to 26.5% and pig seeing a similar increase to 13.4%. It should be noted that the overall representation of bird bones also increases from 1.9% to 10.4% (Bond and O'Connor 1999, Table 91).

The ditches around Norwich castle seem to have been used for large scale dumping of the town's refuse and reveals changes in the economy occurring from the early to the late medieval period (Mulville 2009). In the early phase the majority of the cattle were slaughtered when adult or elderly (over 3-5 years), but in the late phase there is a second peak in slaughter of sub-adult individuals, suggesting that the economy is being tailored towards both working animals and meat production. The mortality patterns for sheep also see a change from being slaughtered between their second and sixth year, with the emphasis being towards the younger end of the range, to the majority of the animals being culled at an older age from the 12^{th} century onwards, which has been interpreted as the effects of the growing wool trade. These patterns are similar to the ones observed in Lincoln where the age distribution for sheep/goat mandibles show a clear trend for animals in the 2-3 and 3-4 year age groups with only a very small number of young individuals, which is interpreted as a sign of an emphasis on both mutton and wool (Dobney et al. 1995, 40). Pigs in Norwich are, as in all other times, culled at under two years old, but their lifespan decreases in later times as well (Mulville 2009, 155). Similar evidence is available for cattle from Southampton. The majority of the animals from the start of the period until the mid-14^{th} century were adults but towards the end of the medieval period (the end of the 15^{th} century) much younger animals start occurring in the assemblages (Bates 2011, 226).

The excavations of the Barbican Well at Norwich Castle uncovered a large faunal assemblage, which covers the end of the late medieval period from the mid/late 15^{th} century to the early 16^{th} century, gives us some detail on the proportions of the livestock species and their mortality profiles right before the post-medieval period (García 2009). At this point in time the castle was no longer in use as a high-status settlement but served as a prison and administrative centre and the baileys were used for industry, disposal of craft and domestic refuse and grazing, all of which are reflected in the assemblage from the well. The relative frequencies of the main livestock species are quite different from any other we have looked at in that there is a fairly even representation in terms of NISP of each of the species with 35% cattle, 39% sheep/goat and 26% pig. The numbers change when calculating the frequencies using diagnostic zones, which should favour large species less, and sheep/goat then take a much larger part of the livestock population with 53% followed by cattle with 27% and pig, being the least numerous, with 20% (García 2009, Table 53a and b). Based on epiphyseal fusion data only 1% of the

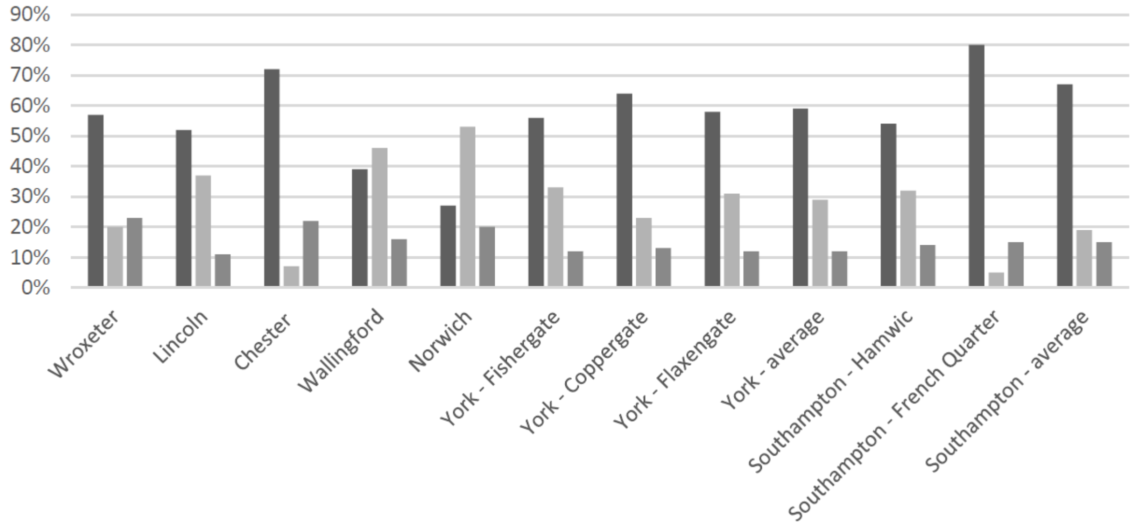

FIGURE 2.9: Summary of the proportions of cattle, sheep/goat and pig by NISP from the medieval period. Source: Bates 2011, 226; Bourdillon and Andrews 1997, 244; Cartledge 1994, Table 12.2; Dobney et al. 1995, Table 11; García2009; Table 53a and b; Hammon 2011, Fig. 2; Holmes 2013, Figure 9.13; O'Connor 1989, Table 40; O'Connor 1991, Table 60

sheep/goat population died as foetal animals and 84% were older than 18 months. Out of these, only 5% appear to have been slaughtered before they were 2.5 years old and 63% survived to be older than 3.5 years indicating that the animals were used in specialised wool production. The fusion data for cattle are radically different from sheep/goat. It suggests that 24% of the bones belong to foetal or neonatal calves, very few were slaughtered in their first year and then 54% were slaughtered when they were between 1.5 and 3 years old with 26-29% of the population surviving past this stage. Pig show the very typical mortality profile for this species, highly suggestive of pure meat exploitation with 64% slaughtered in the first year, another 35% in the second year, and only 1% surviving to 3.5 years old (García 2009, 104,108-109, 115). Butchery patterns show that a new method had been introduced at some point in the medieval period as over half of the cattle vertebrae exhibited sagittal splits, indicating that the animals were split into two sides of beef. Furthermore, 44% of the large mammal rib fragments had chop marks and seemed to be chopped to be a certain length. While sheep/goat bones exhibit fewer butchery marks overall the same trends are observed as for cattle. Pig remains have very few chop marks, especially compared to the other main domesticates, but they appeared to be split into halves as well (García 2009, 105, 109, 116).

Overall, the relative frequencies of the main livestock species in the early medieval period are very similar to the patterns in the Roman period with about two thirds taken up by cattle, a quarter by sheep/goat and the remainder by pig. However, there are considerable variations between sites and, as a general rule, cattle have slightly lower proportions and sheep/goat have slightly higher ones than in the Roman period (Figure 2.9). The butchery evidence is once again similar to the former period with the carcass being divided at the major articulation points into joints of meat, though the marks appear much less systematic and there is no reference to smoking or brining of beef shoulder joints. The animals that do end up in the urban deposits are from adult or elderly cattle, adult sheep and fairly young pigs. These patterns seem to continue throughout the high medieval period and into the late medieval period. At some stage in the last phase of the medieval period, the patterns in faunal exploitation change and much younger cattle and sheep enter the refuse deposits indicating that they were used less for traction and wool and that the economy shifted to accommodate meat producing cattle herds and sheep/goat flocks. These new trends seem to correlate with new butchery methods where the carcasses were split into halves and there was a systematic reduction of the ribcage into portion sized parts.

Figure 2.9 clearly shows the variation between the towns and cities included here. It illustrates that each urban settlement needs to be considered on its own as the faunal profiles of the medieval period do not form immediately predictable patterns. This in turn shows that each of the settlements adds a new piece to the overall image of how animals were utilised in the medieval period across England while demonstrating the individuality of all the regions and eco-zones the towns represent. Nonetheless, it should be pointed out that 'medieval' covers approximately a millennium and that each of the phases within the period are likely to have their own individual profiles that may or may not be similar to averages for the whole period.

2.2.4 Post-medieval period

The post-medieval period described in this section dates from the end of the 15^{th} century and until the mid-18^{th} century. It generally begins with the start of the Tudor Dynasty, but the end of the period is disputed depending on if it is an archaeologist or a historian setting the dates. Several sites do not include the post-medieval material, therefore, the data presented in this review are limited, particularly in comparison to publications on medieval urban faunal assemblages.

The post-medieval faunal assemblage from Walmgate in York covers only a short part of the period from the late 17^{th} to the early 18^{th} century and consists solely of waste from industrial activity which can be related to the structures found at the site. The material contains little else but sheep with 32,438 out of the total 33,788 specimens, and 86% of these are phalanges and metapodia (O'Connor 1984, Table 6 and 8). The ages obtained from 28 mandibles come from three juveniles aged between 2 and 4 months and another two between 6 and 12 months. The remaining 23 mandibles were from 13 adults that were culled when between 3 and 4 years old, eight were from 4 to 5 years old and four from 5 to 7 years (O'Connor 1984, 33). The patterns have been interpreted as a division between younger animals kept for prime meat and older surplus animals from wool producing flocks and would therefore be producing wool of a lower grade and ended up in the hide industry whereas the younger animals were kept separate and ended up in different contexts (O'Connor 1984, 35).

Over 2000 fragments were identified as one of the main domesticates in the post-medieval period in Lincoln. The relative frequencies are nearly identical to the ones from the high and late medieval assemblages in the settlement with 55% cattle, 36% sheep/goat and 9% pig (Dobney *et al.* 1995, Table 10 and 11). Only very few teeth and mandibles were available to study the mortality patterns, but the epiphyseal fusion suggest the presence of several very juvenile individuals and in general over 50% of the intermediate fusing elements are still unfused. The presence of butchery marks on these bones implies that they were used for veal as a side product of dairy production and did not die of natural causes. There is a shift from the emphasis on both mutton and wool production in the medieval period towards a focus on younger and immature animals in the post-medieval period along with a second peak in slaughter of adult animals which are likely to be older ewes suggesting that the wool production is no longer of importance. The mortality profile for pigs indicate that 58% of the animals are culled before reaching 12 months old (Dobney *et al.* 1995, 31, 40, 44). It should be noted that the pigs from Southampton stand out from almost all other assemblages as they are all listed as being mature (Bates 2011, Fig. 6.4).

Unfortunately, as the post-medieval material presented here is only from two sites, one of them being an industrial context, it is not possible to determine any general trends for the period across urban sites in England. The lack of information on the post-medieval period is likely due to a greater archaeological interest in the preceding periods and possible new attitudes to waste disposal which will be discussed further in later chapters. There is therefore great potential to explore how all the changes in society leading up to the Industrial Revolution are reflected in the faunal material.

2.2.5 Other studies

Some of the sites mentioned above had additional studies undertaken to improve our understanding of what we find in the archaeological record and the decisions people made in the past. The following section will include studies of spatial patterning in cattle bone deposition in York; animal sizes at Wallingford and Lincoln, and general studies of tool production in York and Southampton.

Due to the large number of sites with contemporary faunal material in York, J. Bond and T. O'Connor decided to look at inter-site variation in the deposition of different age groups in any one species, as they had observed some sites having significantly different mortality profiles than others such as the Bedern with a high number of calves, and Coppergate, with the majority of animals being prime age for meat (Figure 2.10). Material from the Tanner Row area is likely to have been from craft activities that also included the collection and processing of heads from adult and elderly cattle, the latter of which are not frequently found at other sites. One of the Tanner Row deposits as well as the pit fills from Skeldergate, included a large number of cattle horncores and the latter site also had goat horncores, so it is possible that the area with the two sites was involved in horncore working. At the Bedern site there is an underrepresentation of horncores and other cranial elements in comparison to the proportions of post-cranial elements. It is suggested that the elderly cattle were culled from dairy herds and brought to the Bedern

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FIGURE 2.10: Spatial patterning in deposition of mammal bones across medieval York, summarised to show the apparent contrasts between major sites. Site numbers: 1: 16-22 Coppergate; 2: 24-30 Tanner Row; 6: The Bedern; 8: 21-33 Aldwark; 9: 58-59 Skeldergate. Source: Bond and O'Connor, Fig. 54

on the hoof to be slaughtered and butchered, and at least some of the heads taken to some other location, which might have been Tanner Row (Bond and O'Connor 1999, 385-7, Fig. 54, Table 92).

In the medieval section above, the spatial patterning studies done at Wallingford were described and in addition to these the sizes of cattle, sheep and pigs from the castle area and the Kinecroft within the town were examined as well. Log ratio plots of lengths and widths of cattle and sheep do not show any significant differences, but, while the sample size is very small, the pigs at the castle appear to have had both greater lengths and widths. Furthermore, wither heights of cattle from the castle area were on average 50 mm taller than at the Kinecroft (Holmes 2013, Figure 9.19, 9.20, 9.21, 9.22).

The faunal assemblages from Lincoln were also used to study the development of size in cattle and sheep/goat. Measurements from the tibiae, metacarpals, and metatarsals all show a clear increase in cattle size between the late Saxon and the post-medieval periods. For sheep, the metric data were collected from tibiae, humeri, metacarpals and metatarsals. The evidence from the tibiae and humeri show that there is an overlap with the measurements from the late Saxon and the post-medieval period, but while they also overlap with the medieval data, none of the medieval individuals appear to have grown to the upper range of sizes present in the other two periods. Furthermore, the data from the humeri suggest that the post-medieval caprines are considerably larger than at any other time. Further detail is added by the measurements from the metapodials which can be separated into the early and late post-medieval phases. The data from the two elements suggest that the animals from the early phase are larger than the ones from the late phase (Dobney *et al.* 1995, Figure 41-49 and 60-67).

A thing that is rarely mentioned in the general studies of faunal material is the production of objects made from bone and antler as they are considered artefacts and get described in separate sections or reports as they are frequently worked beyond the recognition of element and species. Nonetheless they are mentioned here as they add detail to our understanding of the uses of animals and how the selection of specific elements for tool making can introduce a bias in the element representation data. While metapodia have been recovered in considerable numbers in almost all settlements described above, where they are often deposited with industrial waste from butchers or tanners, they are also used for everyday items, such as ice skates, which can be found in all medieval periods and in post-medieval times as well. In Southampton 44 bone and antler objects have been described, the majority which cannot be identified beyond material type, and ranging in date from the early medieval to the early modern period. These include handles, needles, composite combs, ice skates, points, gaming pieces and a crossbow nut (Grant *et al.* 2011, 216). R. Hall wrote a section that underlines making tools from bone and antler was something most people were likely to be familiar with unlike people today. Things such as pins and needles can easily be home-made including slightly more complex items such as flutes from bird leg bones. On the other hand, things such as the composite combs found in Southampton require specialist knowledge of how to work with antler and adding different material types together to form a single object (Hall 1996, 86). All the deposits with large quantities of horncores are a testament to the need for workers or craftsmen that have gained specialist knowledge and likely have made a livelihood out of working animal materials.

Some of the assemblages in Anglo-Saxon Southampton were studied with the specific purpose of gaining a better understanding of tool production and cattle bones were present in sufficient numbers to investigate if there was a selection for size. For radii there was no evidence to support the hypothesis and only some indications for tibiae, but the worked metatarsals showed a clear distinction between worked and unworked specimens. This may suggest that bones of the front and hind legs are suitable for different purposes based on the widths of the elements; radii and metacarpi are generally wide and flat providing a suitable working surface without the need for larger specimens. Tibiae and metatarsi, on the other hand, have narrower shafts so larger specimens will have been more useful for tool production. However, the authors point out the possibility that the selection is artificial and only apparent in the archaeological record as the offcuts from larger bones are more likely to leave identifiable fragments, whereas smaller specimens may have been worked so extensively that there are few offcuts left (Riddler with Andrews 1997, 228-229).

2.2.6 Differences, similarities, and common problems

It is clear from the sections above that there are both similarities and differences between each town and city in the patterns observed in their faunal assemblages. While there are no set answers to explain the variations, there are some general factors that will influence the use of the main livestock species. One of these is the geographical location of a site. Some of the locations mentioned, such as York and Wroxeter, are located in highland zones and others, like Norwich and London, are in lowland areas which affects how animals can be kept and which species are better adapted to the region. Furthermore, soil conditions influence the preservation of faunal material. York has been very fortunate with waterlogged conditions in some sites, whereas the natural soils under Chester do not favour bone preservation. Another factor is the connection with major trade routes and high-status citizens such as royalty. These bring in new trends and goods from other sites such as exotic species or maybe new ways to prepare food. Wallingford and Norwich are good examples of how a castle can affect assemblages by having a preference for prime meat from younger animals in certain species.

Post-excavation influences such as funding, decisions made during the analysis, and publication types are vastly important as well. Funding and timeframes for excavation and analysis are the main dictators of what information we can gain from a site. For example, whether there is time for bulk sieving all of the soil or flotation of particularly rich deposits; the amount of material that can be analysed and the level of detail of the analysis is highly dependent on both funding and time. This in turn affects the publication type and what information will be available to the general public and academic communities. At times the faunal report is only a few pages in the appendix of a monograph, while in other cases, the faunal material is given a dedicated monograph. Journal articles often contain vast amounts of information on a specific analysis, such as spatial patterning, but are tailored towards specialised academics, whereas monographs such as 'Heart of the City' (Rowsome 2000), dedicated to the excavations at 1 Poultry in London are written for the general public and are much less useful for further academic analysis.

Besides the broad influences briefly described above, there is long list of things that need to be kept in mind when studying and interpreting the data from archaeological sites some of which will be mentioned here. All the relative proportions listed are based on fragment counts so it is important to understand the biases it introduces. A large animal skeleton, e.g. from cattle, will often be cut and/or fractured into a larger number of identifiable fragments than the remains of a smaller animal, e.g. a sheep. This means that the largest species will often have the highest relative frequencies in an assemblage. The size of an assemblage also impacts the reliability of the data. The smaller the assemblage, the smaller the likelihood that it is representative of the assemblage at the time of deposition. For example, if four sheep mandibles were used for age determination and three were from juveniles and the last one was from an adult animal it should look like a meat producing economy. However, if 150 mandibles were originally deposited the four specimens found are unlikely to characterise the full flock. Furthermore, the context from which they were recovered plays a role; if the mandibles were recovered from a producer site and had no butchery marks, they may have died from natural causes rather than being intend for dietary uses. Likewise, the industrial material from York does not tell us about diet, but pure kitchen waste does not give the full picture either. The last thing to mention here, and one of the most important, is the issue of residuality. If we are to make any reliable interpretations of data, we need to know when they are from. Some deposits have accumulated over several centuries and over time the layers can intermingle, making it impossible to determine what period the material comes from. For example, as economic priorities change mixing of deposits may give mortality profiles that reflect two different types of animal husbandry regimes or the gathered butchery data can show sagittal splitting in much earlier or later periods. These issues can be avoided with good dating of materials such as pottery and having sampling strategies that focus on deposits with low residuality.

Despite the vast number of faunal assemblages that have been studied to date and all the issues we face when studying any kind of archaeological material, there are still plenty of reasons to continue studying more. Table 2.4 shows that only a few of the cities and towns mentioned here have faunal collections evidencing continuous settlement from the Roman period into the post-medieval period. The overviews of the faunal material from each of the historic periods similarly highlights five things: 1) medieval assemblages are the most frequently studied but the factors influencing the substantial differences between the faunal profiles of the various sites are relatively unknown; 2) more in-depth studies are needed of Roman material and the changes that take place following the shift from military to civilian phases; 3) while post-medieval faunal collections are increasingly receiving more attention (e.g. Gordon 2015; Thomas 2005) they still need to receive more attention as this potentials of this material is still relatively unknown and in many cities we have mainly recovered material from industrial sites and it is therefore not representative of the urban diet, butchery practices, or the structures of the herds supplying the meat so when non-industrial material is available it should be explored; 4) only a few studies compare and contrast material from multiple sites and site types within the same settlement and historical period. The fifth and final point: while there are a large number of studies of the separate periods, there are considerably fewer that analyse the transitional phases between the periods or study multiple periods from the same settlement. Transitional phases will be addressed here by paying particular attention to trends on either side of major historical events like the collapse of the Roman Empire and the Norman Conquest rather than just comparing major trends from whole time periods. The Exeter faunal material has the potential to expand upon our knowledge of several of these points: it bridges the three periods, including the Roman military and civilian phases; there are considerable amounts of post-medieval material from a range of different contexts; and lastly, there is great scope for studying inter-site variation as there are multiple sites from a range of contexts and site types that cover each of the periods.

Chapter 3

Methods

3.1 Introduction

The techniques employed in faunal analyses often vary between different sites and researchers with the choice of methods also being affected by the nature of the assemblage itself. While some methods may be chosen out of personal preference there is a large array of other factors to take into consideration. What is the size of the assemblage? How well was the site excavated and recorded? What condition is the assemblage in in terms of excavation methods used, post-excavation damage, and taphonomy? Are the contexts closely dated or do they cover broad periods? Is there a time frame for the analysis? What equipment is available? What are the key research questions and priorities of the project?

The faunal material analysed for this project comes from a large number of sites excavated within the city of Exeter since the early 1970s. The development and refinement of excavation techniques over the past 40 years has corresponded with a continuous improvement in the collections of archaeological material have improved accordingly. While sieving of all the deposits on historic sites is still rare, more systematic sieving has directly resulted in larger quantities of small fragments and small mammal and fish bones being recovered. The sieving gives a faunal profile that is less biased towards the large species which in turn gives us a more accurate picture of the role of faunal resources in the archaeological record (Emery 2004; Payne 1972). The size of an assemblage also determines what questions can be asked. The methods chosen for this project were partially determined by the vast quantity of faunal material from Exeter. As the data collection at these sites was limited both by financial and temporal concerns, the methods utilised had to be efficient in terms of time invested in data collection relative to the usefulness of the obtained data. In addition, to reduce the overall cost, only limited specialist equipment should be required. The methods also had to be well tested or established to make sure that the data and results are standardised and straightforward to use by other researchers interested in the subject and relatively simple to compare to other assemblages. Furthermore, when appropriate, methods that had been applied in previous analyses of Exeter faunal assemblages were used to give some form of continuity between publications and to make the data and results as easily comparable as possible without compromising on quality.

3.2 Recording methodology

The choice of methods for this project has primarily been guided by those used in the previous analyses made by Mark Maltby, Bruce Levitan and Charlotte Coles as well as other scholars who have studied urban English faunal assemblages (Bond and O'Connor 1999; Coles 2015; Dobney *et al* 1995; Levitan 1989; Maltby 1979). Furthermore, additional non-standard methods have been applied particularly to the subjects of bone modification and taphonomy. All the mammal and bird bones were recorded in Microsoft Access and later transferred to Microsoft Excel for data analysis. Fish bones were only recorded as total numbers for each assemblage. Each specimen is listed in the Access database with provenance of the bone; species; element; zone (Dobney and Rielly 1988); side; fusion; butchery; modification (burning, gnawing, root etching, acid damage); fracture type (Outram 2002); Fracture Freshness Index (FFI) score (Outram 2002); fracture history profile (Johnson et al. 2016); dental age; sex; weathering score (McKinley 2004); pathology; metrics; and other relevant notes such as photographs or observations that do not fit in any of the other database categories. Horncore bases are counted when more than 50% complete and only the articular ends of ribs are recorded. Due to the nature of the project and time constraints, only specimens that could be identified to species level (NISP) are included in the analysis. Vertebra and rib fragments were identified to medium or large mammal size as they useful for the butchery study, though all other specimens that could

TABLE 3.1: List of zones used for skeletal part abundances. P - proximal, S - Shaft, D - distal

Element	Zones		
Mandible		All	
Atlas		All	
Axis		All	
Scapula	P: 1-3		D: 4-9
Humerus	P: 1, 2	S: 7-11	D: 3-6
Radius	P: 1, 2	S: 5-10	D: 3, 4
Ulna		All	
Metacarpal	P: 1, 2	S: 5-8	D: 3, 4
Pelvis		All	
Femur	P: 1, 4, 5	S: 2, 3, 6, 7, 8	D: 9, 10, 11
Astragalus		All	
Calcaneum		All	
Metatarsal	P: 1, 2	S: 5-8	D: 3, 4
1st phalanx		All	
2nd phalanx		All	
3rd phalanx		All	

not be identified to a specific species have been included in the category 'unidentifiable'. The "minimal number of animal units" (MAU) were calculated for the main domesticates to take fragmentation and variations in number of elements in skeletons into account (e.g. Crabtree 1990). The MAU was obtained using Binford's (1984) method, sides, and Dobney and Rielly's (1988) zones to ensure the most accurate number. Similarly, assessment of skeletal part abundances was used here to determine the frequencies of individual portions of the animals to aid our understanding of dietary habits, activity areas in the city, site status, etc. The skeletal part abundances were achieved by using zone MAU specific to proximal and distal ends and shafts (Table 3.1).

When the sex of the animal could be visually determined it was noted during the initial recording. This is applied to elements such as domestic fowl tarso-metatarsi, with or without spurs; presence and absence of canines in horse mandibles and the size ans shape of canines in pig mandibles; pelvic morphology; and the identification of bacula. When butchery marks were present their location and type were recorded onto a drawing of the relevant species. All drawings of full skeletons were obtained and adapted from Barone (1976) and element specific ones from Hillson (1996). The species identification was done using the reference faunal collection at the University of Exeter, *Atlas of*

Animal Bones by Schmid (1972) and *A Manual for the Identification of Bird Bones from Archaeological Sites* by Cohen and Serjeantson (1996). Attempts at differentiating between sheep and goat specimens were done for metacarpals, metatarsals, and horncores only. When caprine metapodia were identified Boessneck (1969) was used to determine if the specimen was sheep or goat using metrical analysis of the distal condyles. Speciation of horncores was done visually using the reference collection when needed.

The recording of bone zones was needed to ensure an accurate and consistent documentation of fragmented bones (Dobney and Rielly 1988). Recording specimens as proximal end, distal end, or shaft often results in parts of some elements being counted more than once as an element can be broken into several fragments. For example, where the basic recording might count three right femur shaft from cattle fragments suggesting that they could be from three separate individuals; the zoning method will also count the same three fragments, but knowing which zones are represented will provide the information concerning the number of animals they are likely to have come from.

3.3 Taphonomy

Taphonomy is recorded to understand what processes have affected the bones from the death until the time when they are analysed. As a large number of sites were analysed for this project a common ground for comparing them had to be found, specifically one that takes loss of information on a site to site basis into consideration i.e. taphonomy. The sites were likely to have been differentially preserved i.e. different amounts of information were lost; so to compare the sites to each other and give trustworthy interpretations of the analyses, it was necessary to understand what information was reliable and what biases had been introduced by depositional processes. By recording features such as gnawing, acid damage, burning, and degree of surface weathering it was possibly to estimate what type of information had been lost from each of the sites including age and size bias as small and less robust bones are less likely to survive extended periods of exposure to the elements, burning, and can easily be consumed whole by dogs. Surface features like butchery marks can be difficult to see at the best of times but with poor bone surface preservation they are unlikely to be visible; and species specifications can be missing as a result of canine and rodent gnawing which typically targets the ends of long bones and other diagnostic features. Beyond assessments of information loss, the data on gnawing marks and degree of surface weathering allowed for estimates of relative exposure time of the refuse. Surface weathering increases with the duration of exposure to the elements, dogs, and rodents, meaning, that the longer the exposure time, the higher the amount of recorded gnawing. Information loss and refuse exposure time assessments were ultimately used to form a clearer understanding of the site comparisons and how data that may have been affected by taphonomic processes differed between sites.

As multiple sites were compared for this project, a quick, simple way to estimate and compare information loss was needed to give a general idea of differential preservation between sites. The solution was to use a method designed for recording abrasion and erosion in human skeletal remains which is not commonly applied to zooarchaeology. The method was modified by Jacqueline McKinley (2004) from the original system set out by Behrensmeyer (1978). It gives each specimen a score between 0 and 5, and in severe cases 5+, 0 meaning that the bone has no damage to the surface and 5 is heavy erosion across the whole surface masking the normal surface morphology and with some modification of the bone profile (McKinley 2004, 15, Figure 6). Once a full assemblage had been recorded an mean score was given and then compared to those from other assemblages. Furthermore, the data are studied with regard to FFI scores and the fracture history profiles for each individual assemblage to obtain a more nuanced understanding of the timeline of when some of the processes are likely to have affected the bones. These two methods are discussed in the Fracture analysis section below.

3.4 Aging

There are some clear age indicators in the mammalian skeleton that can be recorded and given an age-at-death estimation such as epiphyseal fusion of the bones and tooth eruption and wear. Fusion of bone ends occurs in known stages throughout the first years of mammals' lives and is visible in most of the commonly recorded elements. Methods using this form of data frequently underrepresent very young animals as their bones are very porous and do not survive well in the archaeological record. Furthermore, the

TABLE 3.2: Fusion stages for cattle, caprines, and pig. P – Proximal, D – distal. Source: Silver 1969

Cattle	Age	Fusion
1	Before birth	P. metacarpal, D. 1st phalanx, D. 2nd phalanx, P. metatarsal
2	7-10 months	P. scapula, pelvis
3	12-36 months	D. humerus, P. radius, P. 1st phalanx, P 2nd phalanx, D. metacarpal, D. tibia, D. metatarsal
4	36-48 months	P. humerus, D. radius, ulna, P. femur, D. femur, P. tibia, calcaneum
Caprines	**Age**	**Fusion**
1	Before birth	P. metacarpal, D. 1st phalanx, D. 2nd phalanx, P. metatarsal
2	6-10 months	P. scapula, P. humerus, P. radius, pelvis
3	13-28 months	P. 1st phalanx, P 2nd phalanx, D. metacarpal, D. tibia, D. metatarsal
4	28-42 months	P. humerus, D. radius, ulna, P. femur, D. femur, P. tibia, calcaneum
Pig	**Age**	**Fusion**
1	Before birth	P. metacarpal, D. 1st phalanx, D. 2nd phalanx, P. metatarsal
2	12 months	P. scapula, P. 2nd phalanx, pelvis, D. humerus, P. radius
3	24-30 months	D. metacarpal, P. 1st phalanx, P. tibia, calcaneum, D. metatarsal
4	36-42 months	P. humerus, D. radius, ulna, P. femur, D. femur, P. tibia

method is only applicable until the animal reaches full skeletal maturity which is approximately 48 months for cattle and 42 months for sheep and pigs (Silver 1969). When analysing faunal economies for the utilisation of primary and secondary products such as meat, milk, wool and traction the full age range of the major domesticates is needed (Legge 1981; Payne 1973). Here, the epiphyseal fusion data from each of the main livestock species were divided into four stages based on Silver's fusion data and are listed in Table 3.1. As the animals are capable of living considerably longer than 3.5 - 4 years other methods using dental data were applied to supplement the fusion data.

Due to their physical attributes teeth tend to survive well in the ground and are therefore less biased towards certain age groups. Though, it should be kept in mind that the small size of some deciduous teeth mean that that they are less likely to be recovered from sites with little systematic sieving of the deposits. Similar to the fusion of bone ends, the replacement of deciduous teeth with permanent dentition follows a known sequence and these data can be used in conjunction with the fusion data to determine discrepancies within the datasets. Moreover, because teeth wear down continuously throughout the life of the animal, the study of these wear patterns has resulted in a number of scholars creating guides to relating tooth wear and age. In this study Silver (1969) was used for tooth eruption in all the studied species as well as horse incisor wear; Halstead (1985)

TABLE 3.3: Pig tooth wear stages used in this thesis

Wear stage	Suggested age	Definition
A1	< 1 week	p3 and p4 unworn
A2	1-7 weeks	p3 and p4 in wear
A3	7-10 weeks	p2 in wear
B	10 weeks - 6 months	All premolars in wear, M1 unworn
C	6-13 months	M1 in wear, M2 unworn
D	13-22 months	M2 in wear, M3 unworn
E	Young adult	M3 in wear, posterior cusp unworn
F	Adult	Both dentine an enamel showing in M3 cusps (Grant 1982 stages c, d, e, f, g)
G	Old adult	Only dentine showing in M3 (Grant 1982 stage ≥ h)

was used for cattle tooth wear; Payne (1973) for sheep/goat tooth wear; and Grant (1982) for pig tooth wear. Halstead's (1985) method was used for cattle rather than Jones and Sadler (2012) as very few cattle were older than stage G. As the system for pig tooth wear is not directly comparable to those of cattle and sheep/goat, a new system was set up for this thesis using Silver's eruption data combined with Grant's wear patterns (Table 3.3). The dental eruption data published in Silver (1969) was collected from live animals, which means that the age ranges are given for when the teeth have erupted through the gums. To ensure that the ages given in this study correspond with Silver's ages a tooth was only considered to be erupted when it exhibited polish on the occlusal surface. While the studies are based on modern data and cannot be guaranteed to be accurate for past populations as different diets will result in different rates of wear, so far tooth wear is still the only commonly applied method to determine the age-at-death for skeletally mature animals.

Both fusion and dental aging methods were used in this study to increase the reliability of any interpretations based on aging data. There may not be that many mandibles with all the molars in place, which is needed for tooth wear analysis, whereas fusion data can be obtained from 12 different elements even when they are in a fragmented state (Silver 1969). Thereby, combining the two types of methods gave a much larger data set which in turn allowed for more reliable interpretations. Furthermore, it was possible to compare and contrast the dental ages to the skeletal ones as deposition of cranial and post-cranial elements may vary spatially.

3.5 Butchery

The study of butchery evidence was used to gain an understanding of the social and historical context in which the profession and techniques of butchery developed. To obtain the data necessary to improve our understanding of this development, information on the type of butchery marks and, when possible, the tool used to make them was recorded. Furthermore, to track changes in butchery techniques and the division of the carcass into smaller portions, detailed recordings of the locations of marks were made by digitally drawing the exact location of each mark onto a skeleton drawing from Barone (1976) of the species in question (e.g. see Figure 4.5) using the programme GIMP. Each specimen with butchery marks was recorded as a separate image layer so the data and images could be manipulated for further visual analysis of the patterns.

Five types of marks are made by humans as part of the butchery process: blow, chop, cut, scrape and saw marks. However, as fracturing is analysed on its own in the following section, only the four latter types are considered here. Butchery marks, particularly cut marks, can look very similar to other types of surface damage such as gnawing, trampling, abrasions and modern trowel damage so the features were looked at with regards to a range of taphonomy and butchery descriptions (Fisher 1995; Lyman 2004, 297-299, 375-297; O'Connor 2000, 45-47; Reitz and Wing 2008, 126-130; White and Folkens 2005, 57-66). While the non-butchery features often exhibit a u-shaped profile, cut marks have distinctive v-shaped profiles, rarely follow the contours of the bone surface, and usually occur in groups of roughly parallel marks near muscle and tendon attachment sites (Lyman 2004). Just like sagittal splitting is seen as a sign of professional butchery, the different types of marks and their locations are usually the result of the retrieval of specific animal products such as meat, hide, horn or sinew. The locations and characteristics of cut marks mean that they are made with a knife or similar bladed instrument and are likely to have been used for defleshing and tendon removal, though, when placed around the shafts of lower limbs and phalanges as well as the skull near the snout and mandible, they are interpreted as evidence of skinning. Chop marks are made when a heavier tool such as an axe or cleaver has been used to chop either partway or entirely through the bone. Like cut marks, they have a v-shaped cross section yet it is much more obvious as it a larger and deeper mark that frequently exhibits polish as well. These butchery features usually occur by the larger joints and at times on shafts and are created during the dismemberment of the carcass. Scrape marks are very similar to cut marks; they are shallow, v to u-shaped series of almost parallel marks running down the bone surface usually produced when filleting the meat of the animal. Due to their shallow nature, these marks are the most likely to be lost in the archaeological record as a result of general wear and surface weathering. In contrast, chop marks can be identified even in heavily weathered specimens. Cut, chop, and scrape marks occur in faunal assemblages from all time periods, but saw marks are a relatively more recent addition to butchery features. As the name suggests, the marks that are considered in this project are made with a saw-like tool that left continuous striations either all the way through a bone or partway through until the bone is snapped in a fresh fracture.

3.6 Fracture analysis

Fracture analysis had not been applied to historical urban assemblages before as it was designed for analysis and identification of bone grease exploitation. In this study, only part of it was applied and instead used for tracking the frequency and techniques used in fracturing bones for marrow extraction.

As with butchery marks, there are different types of fractures which can be divided into three groups: fresh, dry, and mineralised. The fracture pattern is determined by the structural properties of the bone i.e. the amount of collagen to calcium hydroxylapatite. Completely fresh bones have high collagen levels, improving their elasticity and making them break similarly to a twig, whereas dried bones have typically lost their collagen and thereby primarily consist of calcium making them brittle and allowing them to break almost like a digestive biscuit. In more scientific terms, Johnson (1985), Morlan (1984), and Outram (2002) have described how to distinguish the fractures from each other using the fracture outline, texture and angle. Fractures on fresh bones are identified by their helical shape which curves around the shaft, with the surface of the break being smooth and at an acute angle to the shafts surface (Morland 1984). When a dry, mineralised bone fractures the break surface is very granular with a rough feel to it and is at an obtuse or 90-degree angle to the shaft surface; the outline is typically straight varying between diagonal, transverse or longitudinal, but never curving like a fresh fracture (Morlan 1984). Mineralised fractures frequently occur during excavation or analysis so these are recorded as 'new fractures' and can be distinguished from archaeological ones by the light colour of the fracture surface (Johnson 1985). As the loss of collagen happens gradually, fractures can exhibit features that are not consistent with either a completely fresh fracture or a fully dry one such as a textured, but not granular, break surface or a slight curve to the fracture outline. Fractures having a mix of feature characteristics are simply called 'dry' fractures as opposed to 'fresh' and 'mineralised' at the outermost ends of the scale. As briefly mentioned in the butchery section above, 'blows' are often considered as a butchery type but here they are considered in conjunction with fracture patterns as they usually occur with fresh fractures. This type of mark is referred to as an impact scar for the remainder of this thesis. Impact scars are, as the name suggests, the result of striking a bone with a tool or object often making circular cracks around the point and causing a flake to dislodge from the internal surface of the shaft leaving a crescent shaped 'scar' often with a helical fracture spiralling out from it (Outram 2002). At times there will be a smaller rebound scar on the opposing surface of the shaft from where the bone was rested on an anvil and the energy was redirected back into the bone from the force of the strike (Outram 2002). When these types of marks occur along with fresh fractures they are typically interpreted as a human act deliberately intended to gain access to the bone marrow. Nonetheless, fresh fractures frequently occur without any sign of how the bone broke, though they are still typically interpreted as a result of human actions unless the bone also has evidence of canine gnawing as the pressure of the jaw around one end of the shaft can cause the same type of fracture pattern.

To form a detailed image of fracture patterns two different approaches were used: fracture type/first fracture, and FFI scores (Outram 2001). The details on the recording and analysis of first and subsequent fractures that have been applied here are available in Johnson *et al.* (2016). The method takes both the first fracture and any subsequent fracturing into consideration, e.g. the first fracture will exhibit the 'freshest' or most helical characteristics while any fractures sustained later, such as after roasting, will appear as dry or mineralised as described in Outram (2002). Six different fracture combinations can therefore be assigned to a fragment: helical; helical + dry; helical + mineralised; dry; dry + mineralised; and mineralised. To supplement the fracture type records, a Fracture Freshness Index score was given as well (see Outram 2002). The index evaluates the three criteria described above: fracture angle, outline, and edge texture. Each criterion is given a score from zero to two, zero for a criterion consistent with a fresh fracture, and two for consistency with a mineralised fracture. The final FFI score for each fragment combines all three criterion scores and so can range from zero to six. It should be noted that the FFI score is based on the overall specimen characteristics and does not take the fracture combinations described above into consideration; a specimen with both a helical and a mineralised fracture may be given the score three which does not allow for as much detail in interpretations as it does when combining the two methods for evaluating fractures. Once each specimen had been given a score, the average for the assemblage in question was calculated and compared to the other assemblages.

3.7 Measurements

The purpose of applying metric analyses in this project was to assess changes in size of the main livestock species and thereby likely shifts in farming practices or presence of new varieties of livrstock. To map out these changes a series of measurements were taken following the guidelines set out by von den Driesch (1976). The majority of the measurements were taken with digital calipers and longer ones were taken using a measuring board; circumferences and curves were taken with a measuring tape. As animals increase in overall element and body size until they reach skeletal maturity only fused elements have been included here. Additionally, due to the shrinking that can be caused by the heating of bones, no specimens with signs of burning were measured.

To estimate relative shifts in body dimensions and thereby robustness and sexual polymorphism, a handful of key measurements were taken, when possible, from metapodia, humeri, radii, femora and tibiae: greatest length (GL), smallest shaft diameter (SD) when the GL could be measured as well, and breadth of the proximal and distal epiphysis (Bp and Bd). For metapodia an additional measurement of the maximum depth of the

TABLE 3.4: Standards for log-ration analysis

Cow (jersey) (reference collection number 1494)					
Element	***GL/GLl***	***Bp***	***Bd***	***Dd***	***SD***
Humerus	281.0	92.5	80.4	N/A	35.1
Radius	270.0	76.7	72.2	N/A	40.6
Metacarpal	184.0	55.4	53.4	19.8	29.2
Femur	355.0	116.0	97.0	N/A	34.8
Tibia	327.0	92.0	60.7	N/A	36.6
Metatarsal	210.0	44.9	50.0	23.9	23.6
Calcaneum	128.3	N/A	N/A	N/A	N/A
Astragalus	64.7	N/A	N/A	N/A	N/A
Sheep (reference collection number 0043)					
Element	***GL/GLl***	***Bp***	***Bd***	***Dd***	***SD***
Humerus	143.4	40.2	31.5	N/A	15.4
Radius	148.5	33.2	30.2	N/A	17.3
Metacarpal	126.2	23.6	25.2	10.6	14.1
Femur	170	45.1	39.2	N/A	17.2
Tibia	199.5	41.6	25.4	N/A	14.6
Metatarsal	136.3	20.8	24.2	10.3	12.5
Calcaneum	54.1	N/A	N/A	N/A	N/A
Astragalus	27.1	N/A	N/A	N/A	N/A
Pig (reference collection number 1969)					
Element	***GL/GLl***	***Bp***	***Bd***	***Dd***	***SD***
Humerus	216.5	55.5	49.7	N/A	21.9
Radius	158	33.6	41.1	N/A	22
Femur	224	68.3	56.5	N/A	24
Tibia	207.5	60.2	35.4	N/A	24.6
Calcaneum	88.9	N/A	N/A	N/A	N/A
Astragalus	42.8	N/A	N/A	N/A	N/A

distal condyle (Dd) was taken as well. The sheep and goat species were separated metrically by using Boessneck's formula in which measurements taken from the condyles on distal ends of metapodia are used to separate the calculated result into two groups by numbers higher or lower than a set threshold (Boessneck 1969). The measurements taken were the smallest and greatest basal diameter and horncore length when possible (von den Driesch 1967, Fig. 10, no. 41, 42 and 43). As an alternative approach to identifying the presence of new cattle types the width of the M3 was measured as well (Albarella 1997, Fig. 1, 39-40; Davis 2008, 992).

To investigate body size changes in the main livestock species, Meadow's (1999) log-ratio method was used. This method allows for comparisons of measurements from different skeletal parts thereby maximising the number of measurements which can be grouped together. Each measurement taken from the archaeological specimens is compared to the same measurement taken from a 'standard' animal by taking the logarithm of both the specimen measurement and subtracting the logarithm of the standard. This is expressed as:

d = log X – log standard

If the specimen is the same as the standard the log-ratio will be 0; a positive value means the specimen measurement was greater than the standard; and a negative value that it was smaller. The standards used for this study are taken from the zooarchaeological reference collection at University of Sheffield and listed in Table 3.4. A sheep was chosen as the standard for caprines as analyses of the metapodia suggests almost all postcranial bones are from sheep (see Section 7.5).

The log-ratio graphs in Chapter 7 were made by grouping together long bone measurements from the same dimension i.e. breadth, depth, and length as by Meadow's (1999) recommendation. For the length ratio graphs the GLl of astragali and calcanei were included as well.

3.8 Statistical tests

Two types of statistical tests were used during the data analysis for this project: the chi-squared test for testing confidence intervals in kill-off graphs, and the T-test (two sample) for testing whether mean log-ratios are statistically similar or different. All tests were done using an online plat form and a confidence interval of 95% were set for both types of tests. For the chi-squared test, the proportion unfused specimens were tested against each fusion stage. In the T-tests, the full log-ratio datasets for any given species and phase were tested against each other unless otherwise noted.

Chapter 4

The Exeter Faunal Collection

4.1 Introduction

The following chapter includes the results from the analysis of the faunal material for this thesis presented by site and in the following format:

- Site description
- The faunal remains
  - Outline of overall quantification
  - MAU
  - Fragmentation
  - Taphonomy
  - Skeletal part abundances
  - Butchery
  - Aging and sex ratios
  - Metrics

For some of the sites with small assemblage sizes, the format varies slightly, but the content will include the same information when possible. The cut-off NISP is 75 for a phase to be considered on its own and included in the further data analysis for a site i.e. MAU, fragmentation, taphonomy, skeletal part abundances etc.; amounts below 75 are still included in the overall quantification. Phases with lower NISPs are still included in the site groups described in section 4.1.2 below. The results butchery, age and sex, and metrics

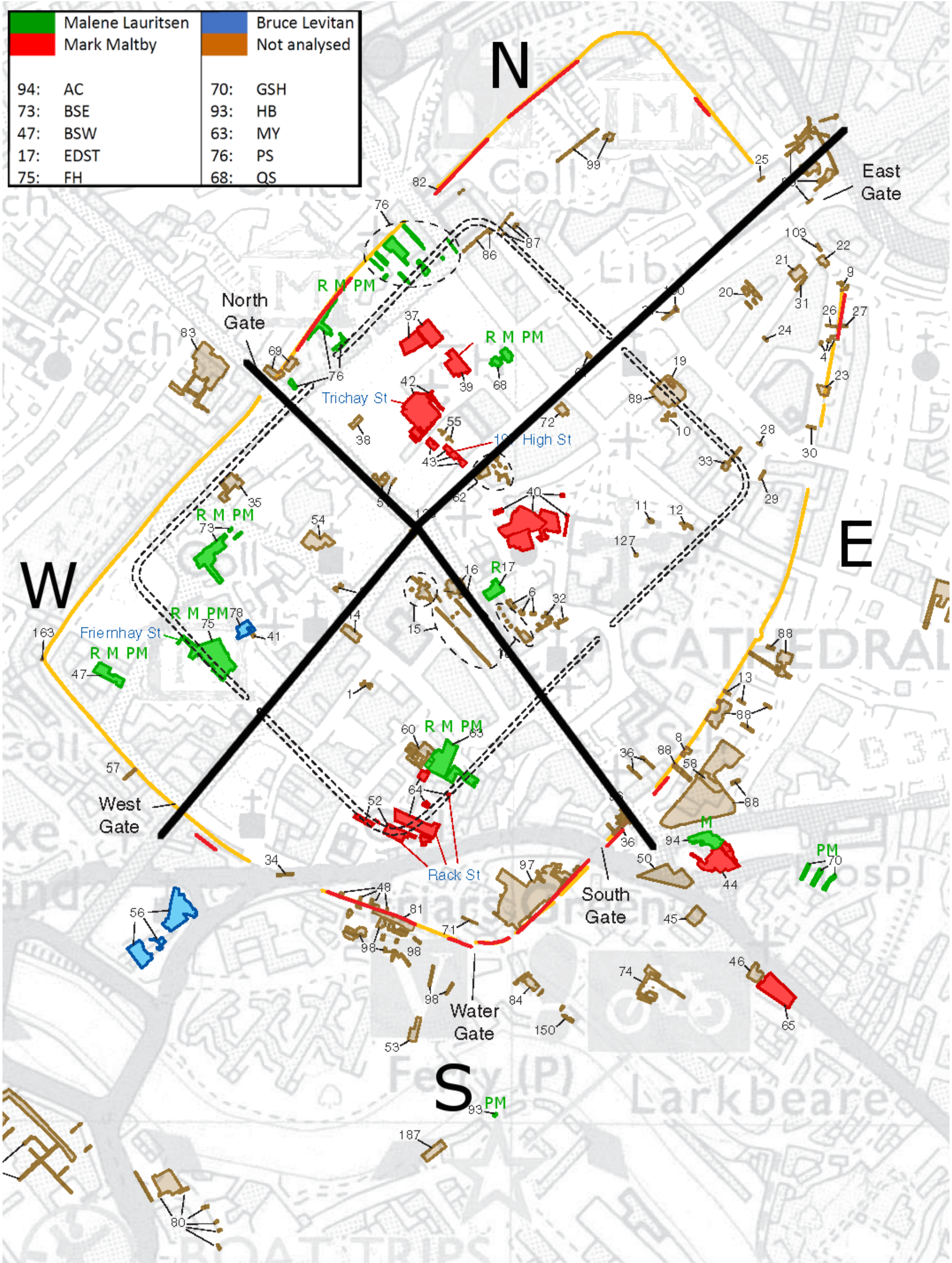


FIGURE 4.1: Map of Exeter with the Roman Military Fortress, City wall and the four quarters. Highlighted areas represent excavations.

are only be included very briefly in this chapter as there is minimal information on a site to site basis. More detailed information on these subjects is available in the relevant chapters.

The complete faunal assemblages from 10 Exeter sites were analysed (Figure 4.1) and just over 40,000 specimens were examined; 12,725 could be identified to mammalian and avian species, 2943 as fish, and the remaining 24.398 could not be identified to species level. The material dates to between AD 55 and the late 18^{th} century and comes from over 45 different animal species identified as follows:

Main domesticates

Cattle (*Bos taurus*)

Sheep/goat (*Caprinae*)

Sheep (*Ovia aries*)

Goat (*Capra aegagrus hircus*)

Pig (*Sus domesticus*)

Game

Red deer (*Cervus elaphus*)

Fallow deer (*Dama dama*)

Roe deer (*Capreolus capreolus*)

Hare (*Lepus* sp.)

Rabbit (*Oryctolagus ciniculus*)

Wild boar (*Sus scrofa*)

Carnivores

Cat (*Felis catus*)

Dog (*Canis familiaris*)

Badger (*Meles meles*)

Pine marten (*Martes martes*)

Other

Horse (*Equus ferus caballus*)

Rat (*Rattus* sp.)

Hedgehog (*Erinaceus europaeus*)

Mole (*Talpa europaea*)

Common lobster (*Homarus gammarus*)

Birds

Domestic fowl (*Gallus gallus domesticus*)

Goose (*Anser* sp.)

Mallard (*Anas platyrhynchos*)

Teal (*Anas crecca*)

Shoveler (*Anas clypeata*)

Duck (*Anatidae*)

Raven (*Corvus corax*)

Crow (*Corvus corone*)

Jackdaw (*Corvus monedula*)

Crow family (*Corvus* sp.)

Cormorant (*Phalacrocorax carbo*)

Eider (*Somateria*)

Grey heron (*Ardea cinirea*)

Gull (*Laridae*)

Hawk (*Accipitrinae*)

Lapwing (*Vanellinae*)

Pigeon/dove (*Columbidae*)

Red grouse (*Lagopus lagopus*)

Thrush (*Turdus*)

Turkey (*Meleagris gallopava*)

Whimbrel (*Numenius phaeopus*)

Woodcock (*Scolopax rusticola*)

TABLE 4.1: List of phases with their corresponding time periods and date ranges

Phase code	Phase name	Date range
1	Roman Military	AD 55-75
2	Roman Civil	AD 75-300
3	End of Roman to Post-Roman	AD 300-670
4	Early medieval	AD 670-900
5	Saxo-Norman 1	AD 900-1050
6	Saxo-Norman 2	1050-1150
7	High Medieval	1150-1300
8	Late Medieval	1300-1500
9	Post-medieval 1	1500-1650
10	Post-medieval 2	1650-1800
R	Undated Roman	
M	Undated Medieval	
UdPM	Undated Post-medieval	

4.1.1 Phasing

The phasing system used here is presented in Table 4.1. Throughout the tables and figures in this chapter the phase codes will be used. There is no data from phase 4 so it not mentioned beyond here. Including the phase in Table 4.1 was deliberate to mark the time gap, AD 670-900, between phase 3 and phase 5. While no archaeological material from Exeter has been securely dated to this period, there may still have been people living within the walls but they may have lived in areas around the cathedral which have yet to be excavated. Different phasing systems were used by Mark Maltby and Bruce Levitan (Levitan 1989; Maltby 1979) but for the purpose of comparison their data will be presented in the system applied here. Table 4.2 lists all the sites from which faunal material was analysed, who did the analysis, and the phases which the material dates to. The key for the site name abbreviations is available in Table 4.3.

4.1.2 Site groupings

As mentioned above, the results in this chapter are presented by site. However, once the data are separated into phases there is often very little information to draw interpretations from. Therefore, the data will be grouped together in ways that will improve our

TABLE 4.2: List of Exeter faunal assemblages, the analysist, what phases the material comes from and the quantity of material. The key for the sites is available in table 4.3 below.

	Lauritsen										Maltby							Levitan		
PHASE	AC	BSE	BSW	EDST	FH	GSH	HB	MY	PS	QS	CC/MM	GS	HL	HS	RS	TS	VS	EB	KP	NP
1		X			X			X	X	X	X	X			X	X				
2			X		X			X	X	X	X	X	X	X	X	X				
3			X					X	X	X	X	X			X	X				
R		X	X	X	X			X	X	X		X								
5	X								X	X										
6	X	X			X			X	X	X		X		X		X				
7	X	X	X		X			X	X	X		X		X		X		X	X	
8	X	X	X		X			X	X	X		X				X		X	X	
M		X	X					X	X	X										
9		X			X	X		X	X	X		X				X		X	X	X
10		X	X		X		X	X	X			X				X	X			
PM		X			X			X	X	X										
NISP	*253*	*1424*	*209*	*102*	*2308*	*92*	*147*	*1866*	*2304*	*4020*	*2310*	*31.080*	*93*	*386*	*1370*	*7153*	*120*	*10.004*	*8509*	*3867*

TABLE 4.3: List of sites referred to in this thesis along with their abbreviations and map numbers.

Site code	Site name	Map number
AC	Acorn	94
BSE	Bartholomew St East	73
BSW	Bartholomew St West	47
CC/MM	Cathedral Close/St. Mary Major	40
EB	Exe Bridge	56
EDST	The Deanery	17
FH	Friernhay St	75
GS	Goldsmith St	37, 39
GSH	Good Shepherd Hospital	70
HB	Haven Banks	93
HL	Holloway St	65
HS	196-197 High St	43
KP	St. Katherine's Priory	-
MY	Mermaid Yard	63
NP	St. Nicholas' Priory	41,78
PS	Paul St	76
QS	Queen St	68
RS	Rack St	52, 64
TS	Trickhay St	42
VS	The Valiant Soldier	44

understanding of how the city is developing over time. Particularly in the medieval and post-medieval periods the groupings are used to gain an understanding of how the four quarters of Exeter within the Roman City Wall are developing in relation to each other. The groups are described below and the quarters referred to are marked on Figure 4.1.

The data from the site Bartholomew St. (BS) in Mark Maltby's report are not listed on its own in this thesis, as they were re-analysed as part of the Bartholomew St West assemblage, the data from which will be presented in this chapter. The faunal material from Bowhill House, located on the outskirts of modern day Exeter, was also analysed, however, the assemblage is very small (NISP is 53). As it is a rural manor house, and therefore not associated with urban Exeter, it will not be considered in this thesis. All sites analysed by Mark Maltby (Maltby 1979) and Bruce Levitan (Levitan 1989, n.d. a, n.d. b) are used as comparative material alongside the more recently analysed material from Princesshay which is located in the East Quarter and analysed by Charlotte Coles (Coles 2015, *forthcoming*). All groupings listed below are subject to the date of the material from the different sites. The sites included in the groups may therefore change in the individual phases the overall time periods have been divided into (see Table 4.2).

***Roman military*:** all sites are analysed as one group as all material is associated with the military fortress itself.

***Roman Civil*:** all sites are considered as one group as the majority of the faunal material from this period was recovered as infill in the Roman Fortress ditch. This means that we do not know where in the town or with which buildings it was originally associated and therefore any grouping of sites based on geographical recovery location is invalid.

***Medieval and post-medieval period*:** as a general rule, sites from these periods have been grouped together based on their location in the four quarters of the city and outside of the city walls (Figure 4.1), however, there are some exceptions.

- The North Quarter site group bulk together the material from PS and QS as this area of the quarter is considered to be high status based on the close proximity to the castle, street names, and other evidence from the archaeological investigations (Advisory Committee Report 1984).

- The East Quarter does not contain any medieval or post-medieval material analysed for this thesis, though the Princesshay excavations (Coles 2015, *forthcoming*) are likely to shed light on the faunal material from these periods.
- In the South Quarter only MY has material from these periods, so this site will be considered on its own.
  - It should be noted that any analysis of material from the South Quarter is not representative of the whole quarter. As only faunal material from a single site has been analysed, and it is located in the southernmost part of the quarter it is not possible to infer anything about the rest of the quarter based on information from this site alone.
- The West Quarter group contains the data from BSE, BSW and FH. BSE and BSW are monastic sites while FH is high status from phase 8 and onwards (Advisory Committee Report 1974 and 1981). Due to the different site functions these sites should not normally be grouped together, but fortunately almost all the phase 6 and 7 material is from BSE and BSW while the vast majority of the material from phase 8 is from FH (see section 4.3, 4.4, and 4.6). Therefore, phase 6 and 7 material from the West Quarter will be interpreted as ecclesiastic and the phase 8 material as high-status. NP will primarily be used as a comparison for FH as it is a Tudor manor house.

***Extra mural areas*:** faunal material from two sites, AC and GSH, have been analysed and are included in this thesis as comparative sites for the relevant phases.

4.2 Acorn (AC)

RAMM accession number: 22/2005

Exeter archive site 94

Excavation year: 1988-89

Extramural

TABLE 4.4: Fragment counts by phase from Acorn.

Phase	NISP	Fish	Unidentifiable
5	4	-	39
6	6	-	14
7	193	12	147
8	49	-	26
Undated	1	-	-

4.2.1 Site description

The Acorn Roundabout excavations were undertaken in advance of road alterations immediately outside the South gate in the City Wall (Figure 4.1) (Advisory Committee Reports 1989; Bedford 1998). Features ranging from Roman military into the post-medieval period were uncovered although faunal material was only present in phase 5-8 features from the medieval period. The Roman remains consisted of three early Roman buildings and parts of a later Roman boundary ditch. The medieval occupation of the site likely began in the 10^{th} or 11^{th} century as evidenced by several Saxo-Norman pits and an 11^{th} century building. The 12^{th} and 13^{th} century features were a number of rubbish and cess pits located at the rear of a tenement fronting onto Magdalen Street. A relatively high-status house was constructed in the early post-medieval phase and likely demolished to make way for mid-17^{th} century Civil War earthwork defences (Advisory Committee Reports 1989; Bedford 1998).

4.2.2 The faunal remains

A total of 491 specimens were analysed, 253 of which were identifiable mammal and bird specimens and another 12 were fish. The vast majority is from phase 7 with only small amounts in the other three phases (Table 4.4). Due to this division, the data from phase 5, 6, and 8 will not be presented beyond Table 4.4, 4.5, and 4.6. It should be noted that, in phase 8, the relatively large number of cat and small mammal bones appear to be from the same cat, with the small mammal bones accounting for ribs and vertebrae (Table 4.5).
MAU: The MAU division between the three major domesticates is 60% cattle, 26% caprine, and 14% pig (Table 4.6), though in terms of NISP, birds follow closely after pig (Table 4.5;

TABLE 4.5: Fragment counts of species by phase from Acorn

Species	5	6	7	8
Cattle	4	4	78	8
Sheep/goat	-	1	32	3
Pig	-	-	19	-
Sheep	-	-	1	-
Cat	-	-	4	7
Dog	-	-	14	5
Red deer	-	-	1	-
Hare sp.	-	-	1	-
Hare sp. cf.	-	-	1	-
Horse	-	-	2	-
Small mammal	-	-	-	25
Medium mammal	-	-	13	-
Large mammal	-	-	12	1
Domestic fowl	-	1	14	-
Pigeon/dove sp. cf.	-	-	1	-

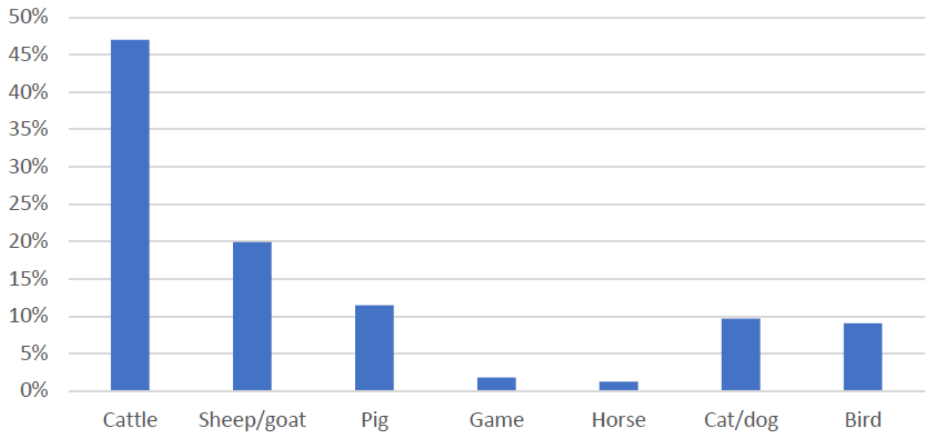


FIGURE 4.2: Frequencies of species and groups by phase form Acorn

TABLE 4.6: MAU absolute counts of major domesticates by phase from Acorn

Species	5	6	7	7	8
Cattle	2	3.25	57.75	60.2%	8
Sheep/goat	-	1	24.50	25.5%	3
Pig	-	-	13.75	14.3%	-

TABLE 4.7: Fragmentation counts and FFI scores for phase 7 from Acorn

Fracture	Amount
Fresh	15
Fresh + dry	4
Fresh + dry + mineralised	0
Fresh + mineralised	3
Dry	25
Dry + mineralised	1
Mineralised	64
Impact scar	1
FFI score	4.93
New break	13
New break/NISP ratio	1:15

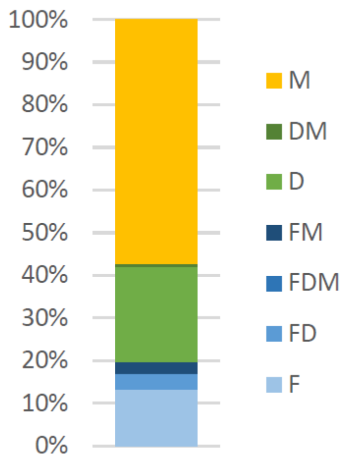


FIGURE 4.3: Fracture history profile of phase 7 from Acorn

Figure 4.2). When looking at all represented species, cattle make up over half of the identifiable specimens with caprines having the second highest representation (Figure 4.2).

Fragmentation: As seen in Figure 4.3, nearly 20% of the specimens with fractures exhibit fresh fractures and one of these has the impact scar from when the bone was fractured (Table 4.7). Approximately 25% had sustained fractures while they were drying out, and over 55% of all fractures occurred after the bones had lost their collagen. A small number of specimens show two fracture types. Seven of these eight specimens were first fractured while they still had high levels of collagen i.e. 'fresh', followed by a later break that resulted in dry or mineralised fracture characteristics.

Taphonomy: almost a third of all specimens from phase 7 had signs of exposure to heat and a single bone had carnivore gnawing marks (Table 4.8). All but two of the bones

TABLE 4.8: Phase 7 taphonomy absolute counts and frequencies from Acorn

Type	Amount
Carnivore gnawing	1
Burning – singed	65
Burning – calcined	1
Carnivore gnawing	0.5%
Burning - all	34.2%
Weathering score average	2.1

with heat damage came from a single context that appeared to have been exposed to the heat after the bones were deposited. The surface weathering scores average at 2 but the individual scores range from 1 to 5. As the relatively low average score suggests, the heat damage to the bones has not affected the surface of the bones in a significant way beyond change in colour. 1 in 15 of all specimens sustained damage during or after excavation resulting in new fractures (Table 4.7).

Skeletal part abundance: The phase 7 skeletal part abundances for cattle, caprines, and pig are shown in Figure 4.4. The limited amount of destructive taphonomic processes affecting this assemblage indicate that they play a minor role in the patterns. However, there seems to be a bias towards the larger and sturdier bones being recovered. Only cattle have cranial elements and all three phalanges represented unlike caprines and pigs where only 1st phalanges are present, and no astragali have been recovered from any of these species. Furthermore, there appears to be a lack of late fusing epiphyses such as the proximal humerus, proximal and distal femur, and proximal tibia. For cattle, the whole body is present, but proximal and shaft metapodia are by far the most represented with 36% of all identified specimens. Scapulae, followed by shaft humeri and shaft femora, have the highest representation after metapodia. The metapodia are most likely to be waste material from butchery or craft activities, whereas the scapulae, humeri and femora are more likely to be food waste as they are meat yielding elements unlike metapodia. As opposed to cattle, the whole skeleton of caprines is not present. For this species, the meat yielding elements (shoulder and tibiae) are the most frequent, followed by metapodia. However, heads, radii, ulnae and femora are missing entirely. Pig heads are not present

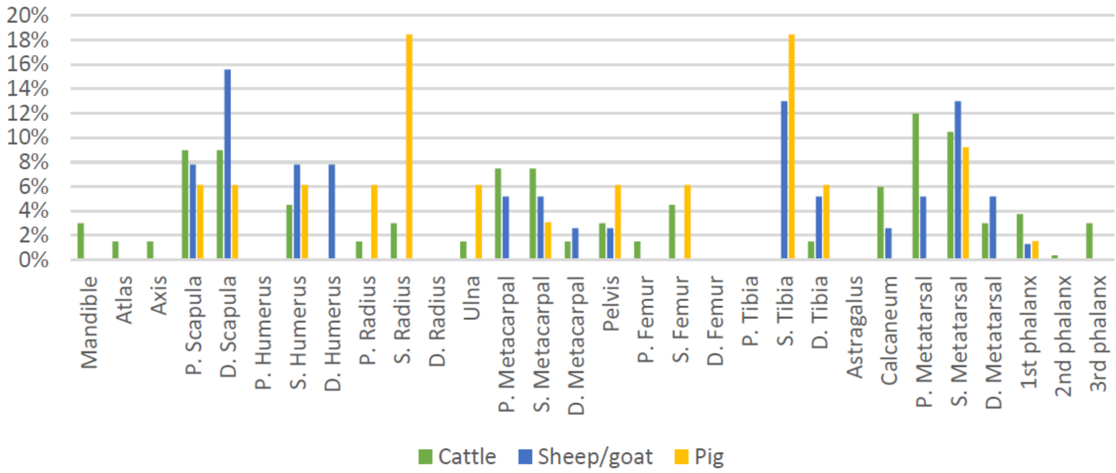


FIGURE 4.4: Skeletal part abundances for major domesticates from phase 7 at Acorn. NB: pig metapodia are listed as shaft metapodia

TABLE 4.9: Summary of cattle measurements from Acorn, with number of specimens, average, minimum and maximum measurements

Cattle		Phase 7			
Element	Measurement	*n*	Average	Min.	Max.
Horncore	Greatest (o-a)	1	44.2	44.2	44.2
	Least (d-b)	1	35.6	35.6	35.6
Metacarpal	Bd	1	63.3	63.3	63.3
	Dd	1	31.4	31.4	31.4
	Bp	2	51.35	46.7	56
	GL	1	180	180	180
	SD	1	33.9	33.9	33.9
Metatarsal	Bd	2	45.15	40.9	49.4
	Dd	2	25.1	23.8	26.4
	Bp	3	35.33	22.9	45.3
	GL	2	191.5	191	192
	SD	2	19.75	18.1	21.4

either, though, taking the recovery bias into account, the rest of the skeleton is represented and most of it in equal amounts, though, shaft radii and tibia are three times as frequent as most other element parts suggesting a bias towards meaty bones.

Butchery: Only cattle had enough cases of butchery to be included here. Nine cases were recorded, seven were chop marks and two cut marks (Figure 4.5). Six of the chop marks were located on scapulae and their locations are consistent with trimming for smoking or brining of the shoulder (Figure 4.6).

Aging - fusion and dental wear: The relative proportions of stage 4 fused and unfused elements in cattle, caprines, and pigs are shown in Figure 4.7. All caprines and pigs were

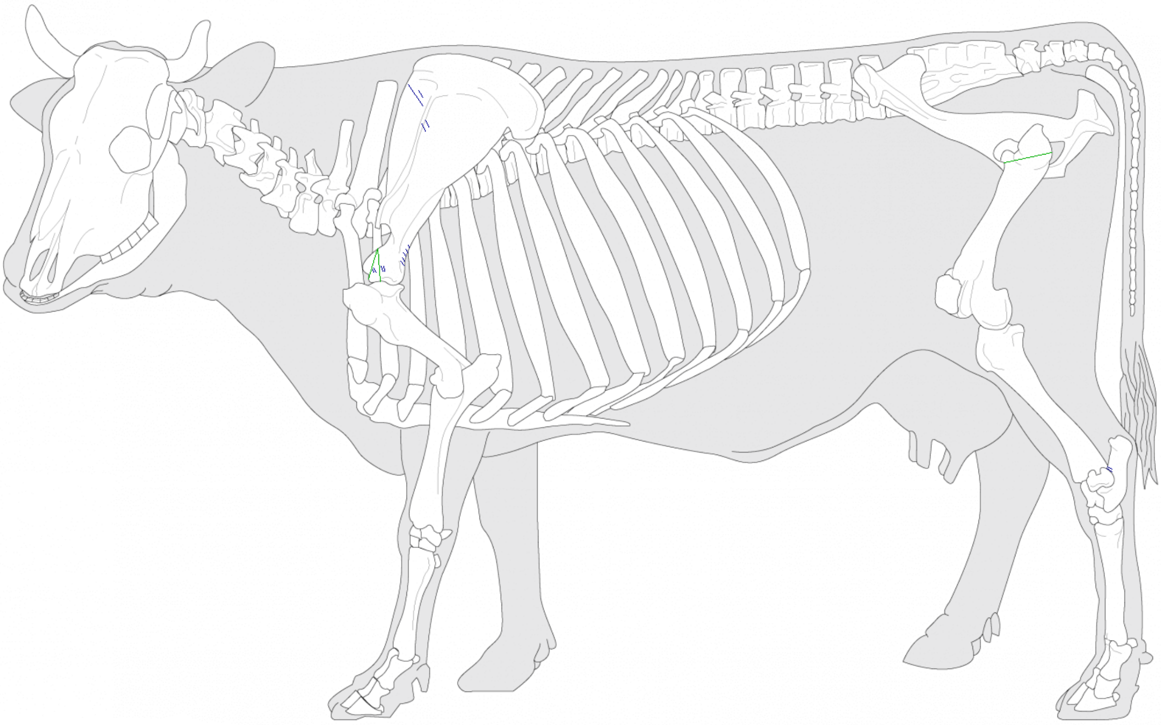


FIGURE 4.5: Cattle butchery from phase 7 at Acorn. Key: green - chop; blue - cut

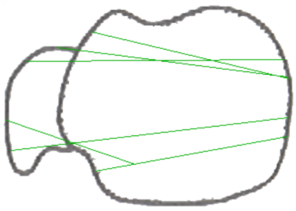


FIGURE 4.6: Butchery on proximal cattle scapulae from phase 7 at Acorn. Key: green - chop

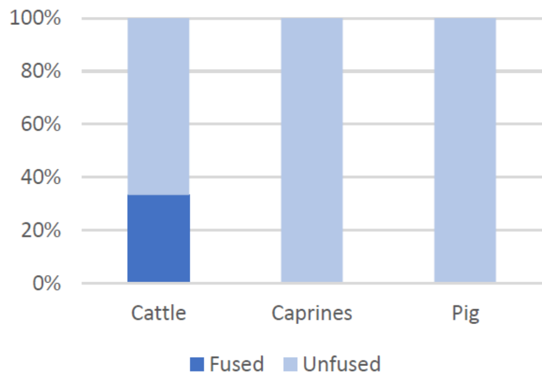


FIGURE 4.7: Stage 4 fusion in cattle, caprines, and pigs from phase 7 at Acorn

killed prior to this stage which is highly suggestive of rearing for meat. As over 35% of cattle live past full skeletal maturity, these are more likely to be kept for a combination of meat and secondary products. Only a single mandible from Acorn was suitable for tooth wear analysis, it was a cattle mandible with wear stage I.

Sex: No specimens were suitable for recording of sex.

Metrics: Summaries of the measurements from cattle are presented in Table 4.9. Phases with fewer than five measurements from a species have not been included which is why caprines and pigs are not listed here.

4.3 Bartholomew St. East (BSE)

RAMM accession number: 10/2005

Exeter archive site 73

Excavation year: 1980-81

West Quarter

4.3.1 Site description

The Bartholomew St. East excavations were undertaken in advance of refurbishment of existing buildings and the construction of new ones (Advisory Committee Report 1981; Salvatore and Simpson n.d.). They covered an open area excavation along Bartholomew Street East and two smaller trenches off Mary Arches Street. The Roman levels revealed Roman military barracks and a Civil phase building parallel to a road as well as a 4^{th} century boundary ditch. The Civil phase building was destroyed by a fire in the 3^{rd} or 4^{th} century and stake-holes were later cut into these fire damaged layers. In the medieval period, this area lay within the precinct of St. Nicholas Priory and was most likely used for orchards and kitchen gardens. The presence of multiple 12^{th} and 13^{th} century pits suggest that domestic tenements were present along the excavated part of St. Mary Arches Street, and that this small area was only incorporated into the priory grounds at the end of the 13^{th} century. Unfortunately, no information is available on the post-medieval features in these excavations (Advisory Committee Report 1981).

TABLE 4.10: Fragment counts by phase from Bartholomew Street East

Phase	NISP	Fish	Unidentifiable
1	32	-	203
6	518	9	1327
7	399	11	956
8	77	1	134
9	4	-	-
10	84	-	197
R	155	1	396
M	108	1	362
PM	21	-	28
Undated	26	-	157

4.3.2 The faunal remains

5207 specimens were analysed from these excavations, 1424 were identifiable, 23 fish, and the remaining 3760 were unidentifiable (Table 4.10). Over 1100 of all identifiable specimens are medieval which limits our understanding of this site towards this particular period. A number of elements could be specified to either sheep or goat. All goat specimens are horncores whereas the sheep specimens are mainly metapodia suggesting that these animals may have served different purposes. In terms of NISP, cattle dominate, closely followed by caprines (Figure 4.10 and 4.11). Game species are present in three phases, but only in very small numbers. Birds are present too, mainly in the form of domestic fowl. Phase 1, 9 and the general post-medieval specimens have not been included beyond Figure 4.8 and Table 4.10 as the samples are too small to be fully representative of these phases.

MAU: Overall, in the Medieval period at Bartholomew Street East, cattle were the most well represented, closely followed by caprines and pigs the least (Table 4.12 and Figure 4.9). The MAU proportions for all three species are fairly stable throughout the medieval phases, however, by phase 10 caprines make up nearly 75% of the main livestock species and cattle the remaining specimens. It should be noted that only 84 specimens were identified from this phase, so the small number may have skewed the proportions (Table 4.10 and 4.11).

Fragmentation: Overall, the fracture history profiles for the six phases show minimal differences, suggesting that the proportion of bones fractured for marrow extraction is stable throughout time (Figure 4.10). Similarly, the proportions of dry fractures occurring while

TABLE 4.11: Fragment counts of species by phase from Bartholomew Street East

Species	1	6	7	8	9	10	R	M	PM
Cattle	12	217	174	30	2	31	85	55	4
Sheep/goat	9	158	115	24	1	42	21	21	8
Pig	9	67	36	9	1	3	31	16	2
Sheep	-	6	7	-	-	-	1	-	1
Goat	-	5	5	-	-	-	-	2	-
Cat	-	1	1	1	-	-	1	-	-
Dog	-	1	-	8	-	-	3	-	-
Roe deer	-	1	-	-	-	-	-	-	-
Red deer	-	2	-	-	-	-	1	-	-
Rabbit	-	-	-	-	-	1	-	-	-
Horse	1	4	4	2	-	-	1	4	-
Medium mammal	-	24	23	1	-	5	3	3	3
Large mammal	-	28	24	1	-	1	6	3	2
Domestic fowl	1	4	7	-	-	-	1	3	1
Goose	-	-	3	-	-	1	-	1	-
Dove/pigeon sp.	-	-	-	1	-	-	-	-	-
Raven	-	-	-	-	-	-	1	-	-

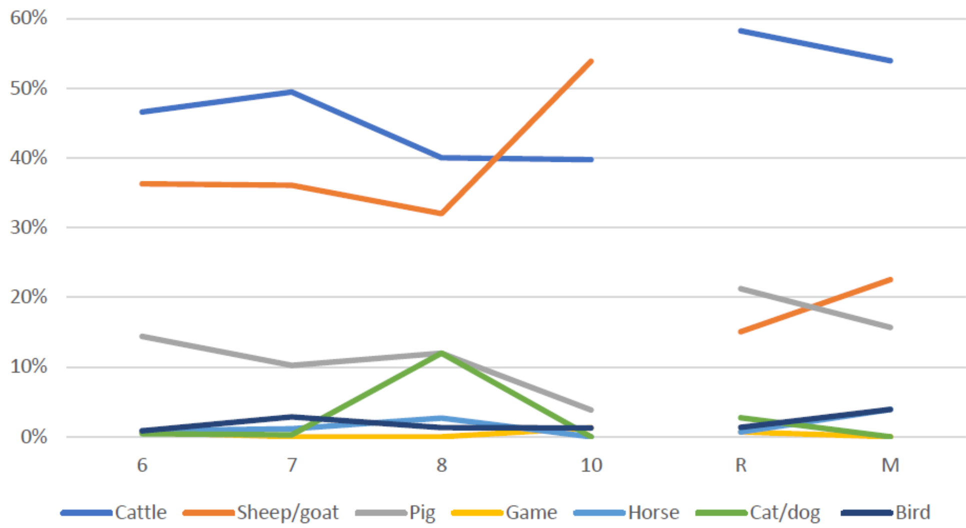


FIGURE 4.8: Frequencies by NISP of species and groups by phase form Bartholomew Street East

TABLE 4.12: MAU absolute counts of major domesticates by phase from Bartholomew Street East

	6	7	8	10	R	M
Cattle	123.5	100	17.75	9.5	44.5	31.75
Sheep/goat	111.25	100.5	15	26	13.75	19
Pig	42.5	22.75	7	0.25	18.5	7.5
Cattle %	45	45	45	27	58	55
Sheep/goat %	40	45	38	73	18	33
Pig %	15	10	18	1	24	13

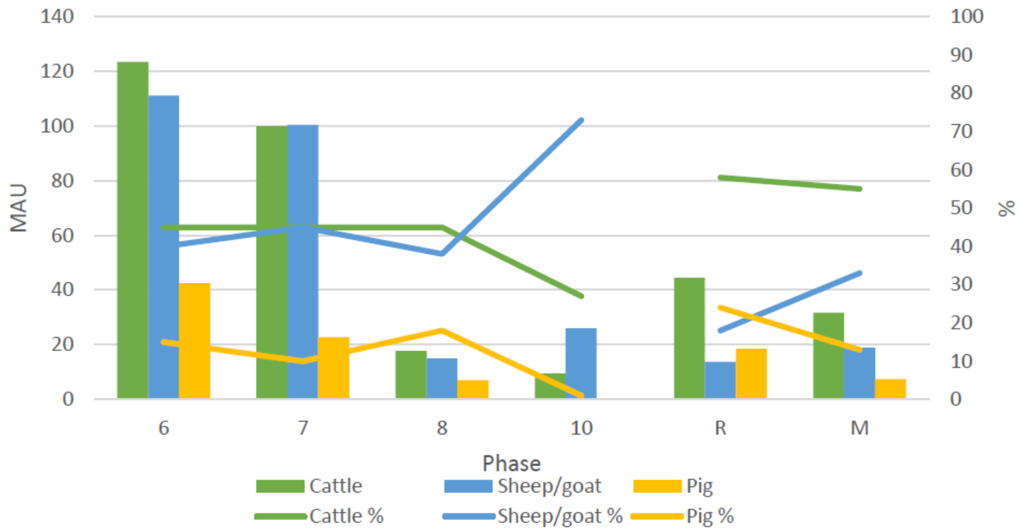


FIGURE 4.9: MAU absolute counts and relative frequencies of major domesticates by phase from Bartholomew Street East

TABLE 4.13: Fragmentation counts and FFI scores by phase from Bartholomew Street East

Fracture	6	7	8	10	R	M
Fresh	59	51	6	6	15	14
Fresh + dry	0	0	0	0	0	0
Fresh + dry + mineralised	0	0	0	0	0	0
Fresh + mineralised	5	3	1	1	2	0
Dry	48	44	18	5	13	10
Dry + mineralised	3	1	0	0	0	0
Mineralised	168	97	15	23	32	25
Impact scar	0	1	0	0	0	0
FFI score	4.6	4.2	4.2	4.7	4.25	4.1
New break	72	54	7	15	25	7
New break/NISP ratio	1:7	1:7	1:11	1:6	1:6	1:15

the bones were drying out and after they had lost all their collagen show little variation over time. Only in phase 8 do the trends vary but this may have been affected by the low NISP (Table 4.13). In this phase, dry fractures account for 45%, and thereby the majority, of all recorded fractures, unlike all other phases where mineralised fractures are the most frequent with a minimum of 50% of all fractures. The lowest frequency of fresh fractures also occurs in this phase indicating that during the late medieval period marrow extraction was slightly less common and that, for some unknown reason, the bones were much more likely to have been fractured after they started to lose their collagen content.

Taphonomy: the surface weathering of the bones changes minimally over time, though with the youngest bones being slightly less weathered than the older Roman ones (Table

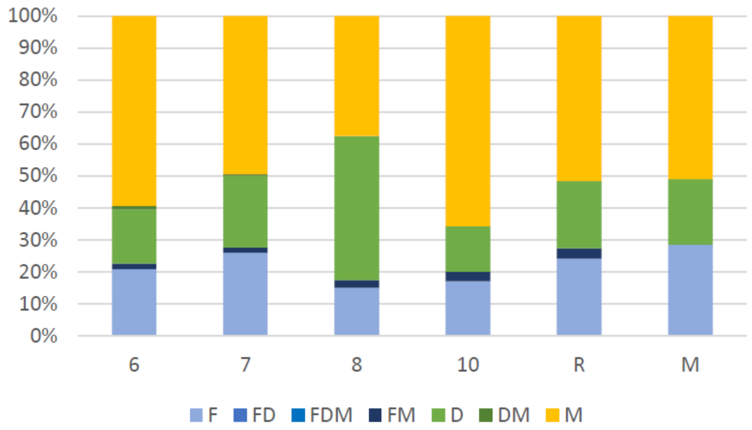


FIGURE 4.10: Fracture history profile by phase from Bartholomew Street East

TABLE 4.14: Taphonomy absolute counts and frequencies by phase from Bartholomew Street East

Type	6	7	8	10	R	M
Carnivore gnawing	2	10	2	-	4	1
Burning – singed	-	2	-	-	2	1
Burning – charred	-	1	-	-	-	-
Carnivore gnawing	0.4%	2.5%	2.6%	-	2.6%	0.9%
Burning (all)	-	0.75%	-	-	1.3%	0.9%
Weathering score average	2.2	2.2	2.2	2.1	2.3	2.1

4.14). The Bartholomew Street East assemblage has sustained little damage by taphonomic processes. Phase 7 stands out as having more cases of carnivore gnawing than all other phases combined. Similarly, it has three examples of heat damage, matching the number identified in the other phases. The amount does not seem to correlate with the NISP for each phase, as phase 6 has the highest NISP with 518, but only has two instances of gnawing, whereas phase 8 only has a NISP of 77, but also has two instances of gnawing. Therefore, carnivores must have had differential access to household waste material in the different phases, suggestive of varying waste disposal practices over time. Based on the assumption that carnivores were present in equal amounts over time, and the varying ratios of gnawing to NISP, is appears as if phase 6 sees the quickest waste deposition and phase 7 the slowest.

Skeletal part abundance: The following three graphs depict the changing trends of skeletal part abundances for cattle, caprines, and pigs (Figure 4.11, 4.12, and 4.13). Generally, for all three species the whole body is represented though some elements are more frequent than others and there are variations within the individual phases, particularly when moving into the post-medieval period. There appears to have been a recovery bias against late fusing epiphyses and small elements as can be seen in the low numbers of proximal humeri, proximal tibiae and phalanges. Taphonomic processes are unlikely to have caused these trends as described above. Atlas and axis have only been identified occasionally as they are prone to fracturing making them difficult to identify to a species level.

For cattle, metapodia are typically the most frequent, particularly metacarpals in phase M and 10, and femurs are the least frequent of the limb bones, occuring only in phase 6 and 7. In the Roman period mandibles are the most frequent followed by metapodia and scapulae, whereas femurs and tibiae are hardly present. Going into the medieval period, metatarsals are most frequent followed by humeri and radii. In the late medieval period (phase 8) shaft radii occur in much higher numbers than at any other time and in the general medieval phase metacarpals are present in twice as frequent than in any other medieval phase. The trend for high frequencies of metacarpals is still seen in phase 10 unlike metatarsals which have some of the lowest frequencies of this phase. Notably, scapulae are present in equal amounts to the metacarpals in this phase while humeri, radii, femurs and metatarsals are not present at all suggesting that the animal parts are procured or used in a different way than in the preceding periods.

Throughout time, caprines appear to see little change in body part representations, though there are exceptions. In the Roman period metacarpals are present in much higher frequencies than in any other phase meanwhile femurs and tibiae are not present at all. In phase 6 the whole skeleton is present in relatively equal numbers, when taking taphonomy and recovery biases into account. However, this trend changes as we move past AD 1150 and into phase 7 where mandibles, humeri and radii are the most frequent even though the whole skeleton is still present. In phase 8, the trends are once again similar to phase 6 though with shaft radii, pelves and distal tibiae being more frequent than the other element parts. As for cattle, the trends in phase 10 (the post-medieval period) are very suggestive of lower limbs being cut off by the distal radius and distal tibia and deposited somewhere else, as the elements below these locations are either absent or occur in very low numbers.

Phase 10 has not been included here for pig as only a single specimen was recovered from this phase. In the Roman period, less than half of the skeletal parts are present, and the majority of these are from the front half of the body. Mandibles and scapulae are twice as frequent as any other part whereas lower legs are almost completely missing. The front half of the body, in particular scapulae and ulnae, is still the most well represented in phase 6 and 7. Though the whole body is now present, the lower legs, i.e. metapodia and phalanges, continue to be the least frequent. In phase 8 only five of the 17 elements are present, once again primarily from the front half, and the radii parts represent over half of the total amount. This trend is nearly identical to the general medieval phase, though with scapulae being more frequent.

Butchery: only phase 6 cattle specimens have enough recorded butchery to be included here (Figure 4.14). A combination of chop, cut and saw marks are mainly located around joints suggesting that the animals were divided into smaller portions by separating limbs and elements at the joints.

Aging - fusion: Figure 4.15, 4.16, and 4.17 presents the relative proportions of stage 4 fused and unfused elements from cattle, caprines, and pig. Stage 4 is the final fusion stage, so the data show the proportion of animals that had fully fused skeletons against the ones that died before this stage. The lack of any fused elements in Figure 4.17 clearly show that pigs were reared for meat alone, as none survived to full skeletal maturity. Cattle and caprines show similar patterns for phase 6 and 7 where most animals are reared for meat, but an increasing proportion is kept for secondary products (Figure 4.15 and 4.16). In caprines this increase is steady throughout phase 6, 7 and 8, but in cattle, all animals are kept for secondary products in phase 8.

Aging - dental wear: Table 4.15, 4.16, and 4.17 present absolute counts for the number of mandibles of cattle, caprines, and pigs at each wear stage. Not enough data are available to be presented further here.

Sex: Table 4.18 presents the absolute counts for identified male and female cattle, caprines, and pigs. For the phases where data are present, males are typically more frequent than females, though these trends may be heavily biased by the difficulties in identifying sex

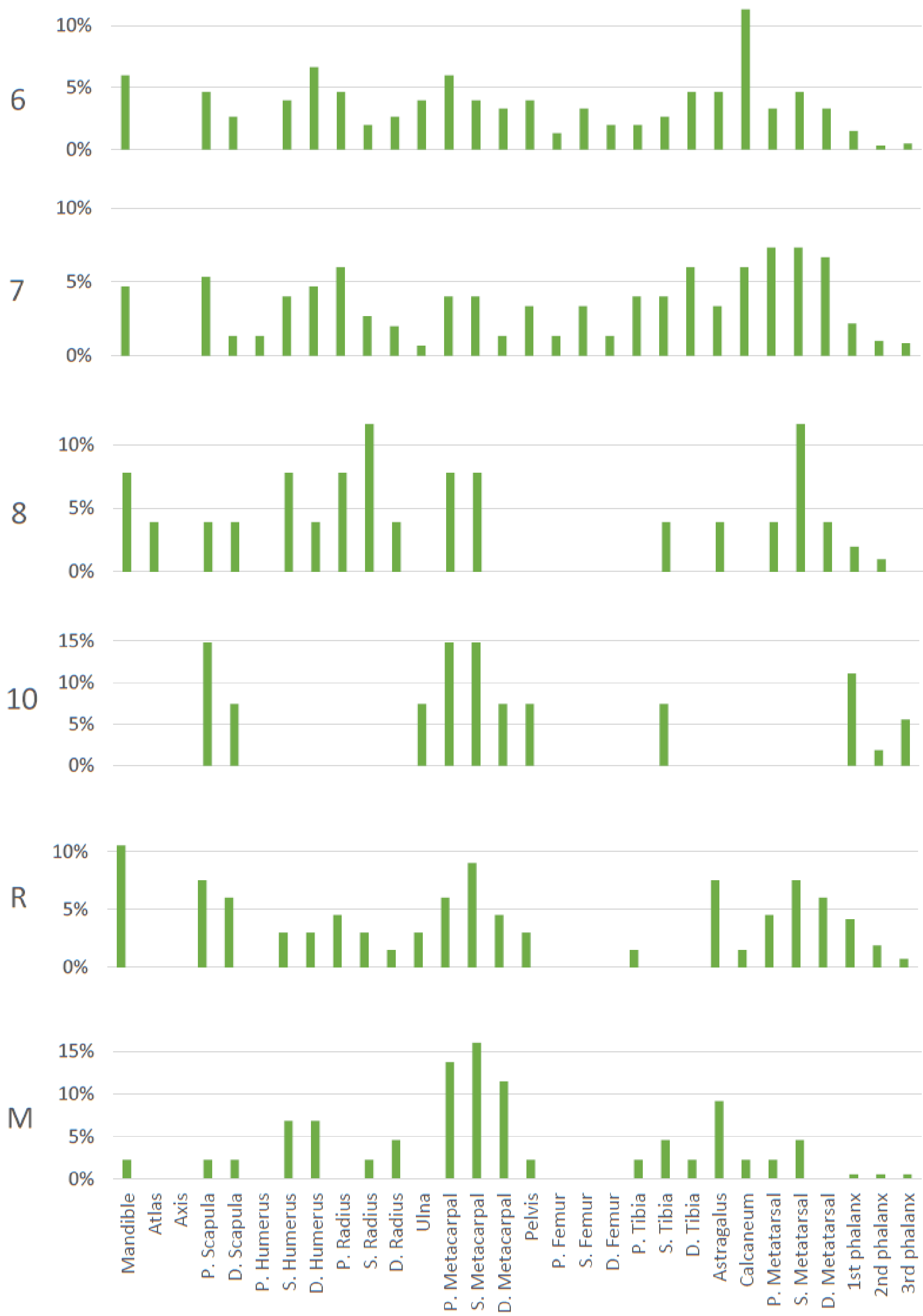


FIGURE 4.11: Skeletal part abundances by MAU for cattle by phase from Bartholomew Street East

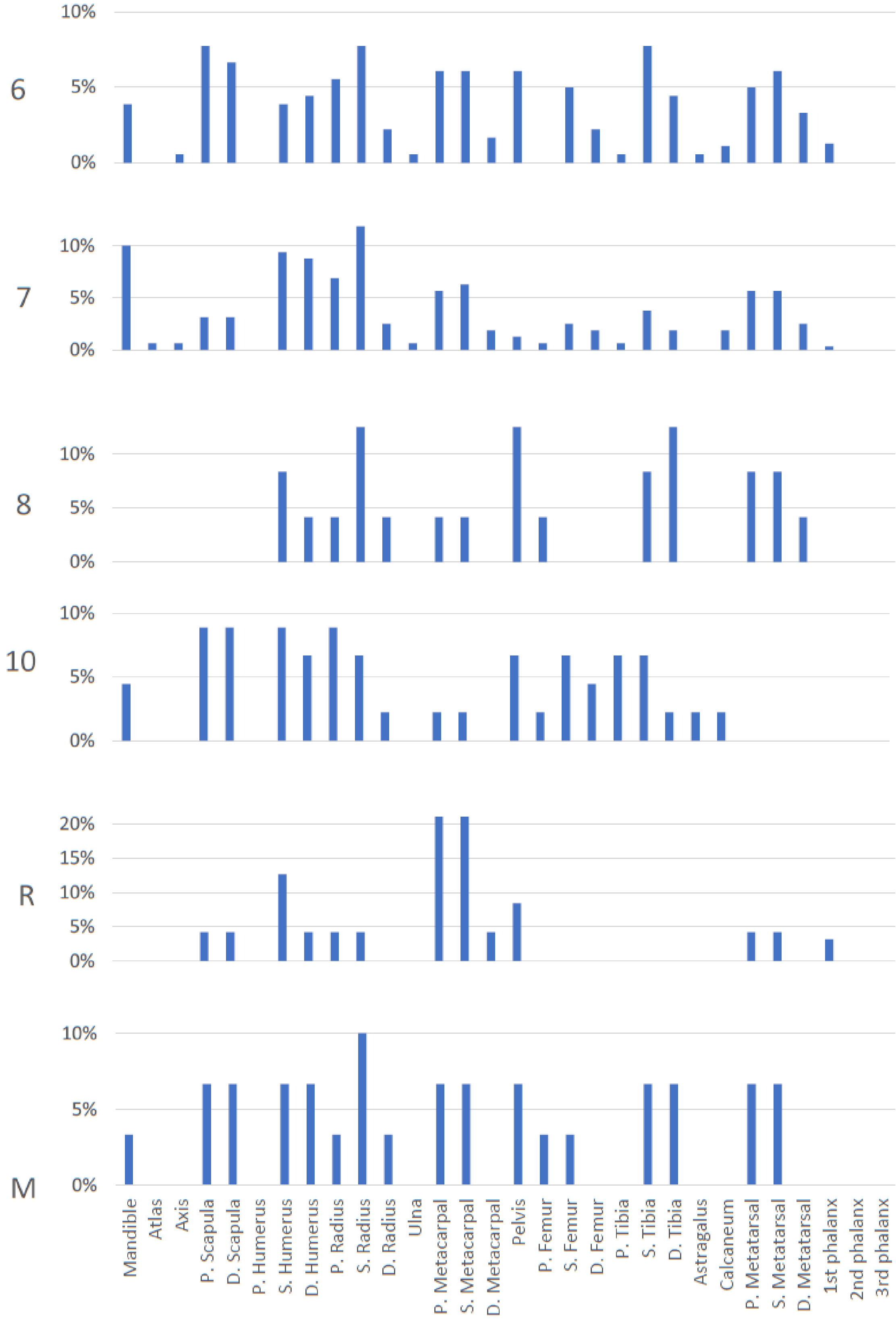


FIGURE 4.12: Skeletal part abundances by MAU for caprines by phase from Bartholomew Street East

FIGURE 4.13: Skeletal part abundances by MAU for pig by phase from Bartholomew Street East

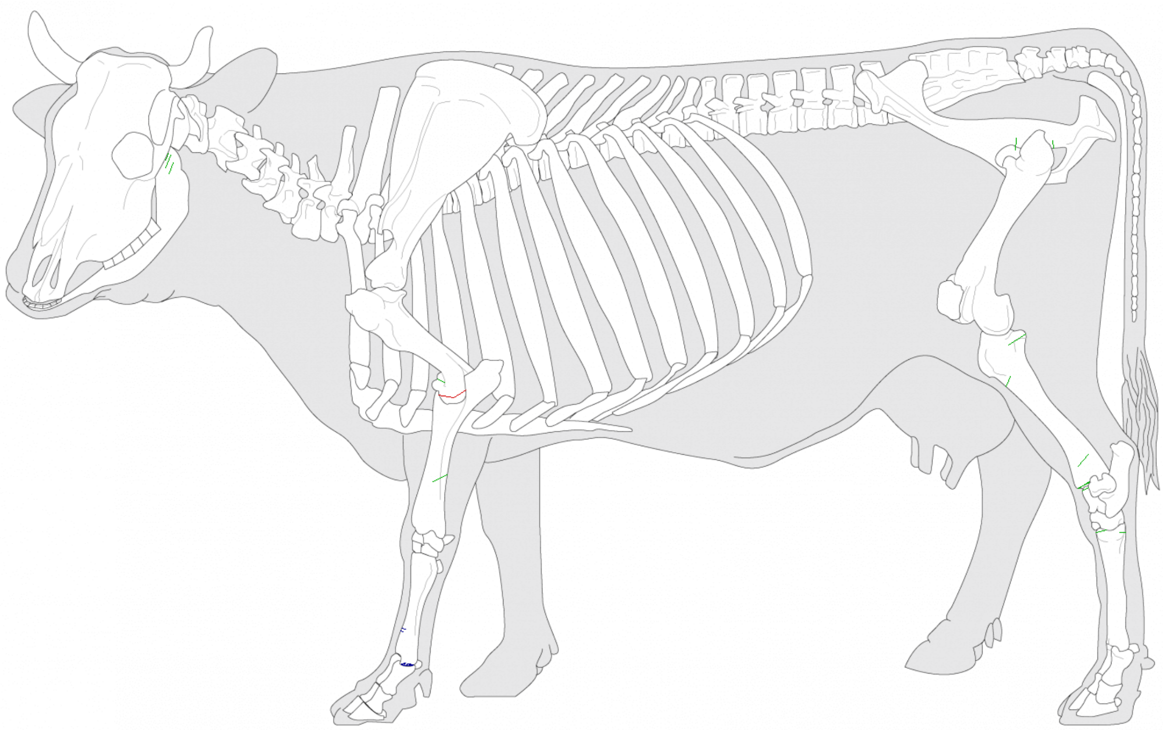


FIGURE 4.14: Cattle butchery from phase 6 at Bartholomew Street East. Key: green - chop; blue - cut; red - saw

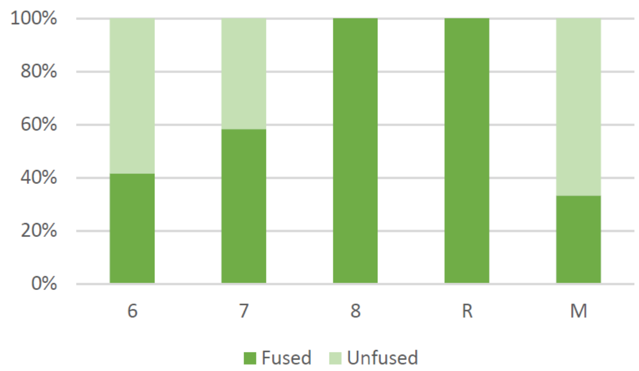


FIGURE 4.15: Stage 4 cattle fusion by phase from Bartholomew Street East

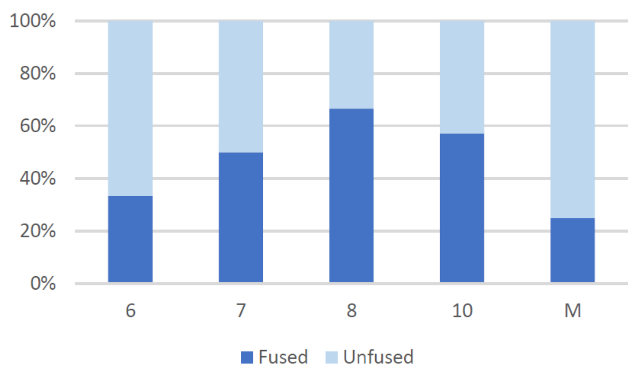


FIGURE 4.16: Stage 4 caprine fusion by phase from Bartholomew Street East

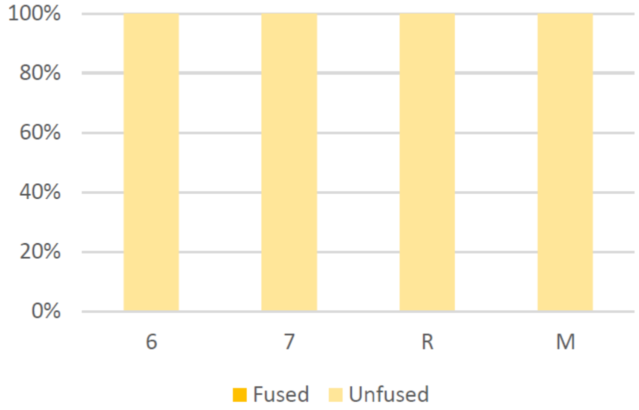


FIGURE 4.17: Stage 4 pig fusion by phase from Bartholomew Street East

TABLE 4.15: Cattle tooth wear by phase from Bartholomew Street East

Wear stage	6	7	8	10	R	M
A	-	-	-	-	-	-
B	-	-	-	-	-	-
C	-	-	-	-	-	-
D	-	-	-	-	-	-
E	-	-	2	-	-	-
F	-	-	-	-	1	-
G	1	-	-	-	1	-
H	-	-	-	-	-	1
I	-	-	-	-	-	-

TABLE 4.16: Caprine tooth wear by phase from Bartholomew Street East

Wear stage	6	7	8	10	R	M
A	-	-	-	-	-	-
B	-	-	-	-	-	-
C	-	1	-	-	-	-
D	-	-	-	-	-	-
E	2	-	-	1	-	-
F	2	4	-	-	-	-
G	1	2	-	1	-	-
H	-	-	-	-	-	-
I	-	-	-	-	-	-

TABLE 4.17: Pig tooth wear by phase from Bartholomew Street East

Wear stage	6	7	8	10	R	M
A1	-	-	-	-	-	-
A2	-	-	-	-	-	-
A3	-	-	-	-	-	-
B	-	-	-	-	-	-
C	-	-	-	-	-	-
D	-	-	-	-	2	-
E	2	-	-	-	1	-
F	1	-	-	-	1	-
G	-	-	-	-	-	-

TABLE 4.18: Absolute counts of sex for major domesticates by phase form Bartholomew Street East

		6	7	8	10	R	M
Cattle	Male	1	1	-	-	-	1
	Female	-	1	-	-	1	-
Caprines	Male	6	3	-	-	-	1
	Female	5	-	-	-	1	-
Pig	Male	1	-	-	-	1	3
	Female	2	-	-	-	-	-

in faunal remains.

Metrics: Summaries of the measurements from cattle and caprines are presented in Table 4.19 and 4.20. Phases with fewer than five measurements from a species have not been included here which is why the metric data from pig is not present here.

TABLE 4.19: Summary of cattle measurements from Bartholomew Street East, with number of specimens, average, minimum and maximum measurements

Cattle		Phase 2				Phase 6				Phase R				Phase M			
Element	Measurement	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.
Astragalus	GL1	*1*	55.8	55.8	55.8	*1*	57.1	57.1	57.1	*1*	57.11	57.1.	57.11	*3*	57.78	51.19	63.77
Femur	Bd																
	Bp																
	GL																
	SD																
Horncore	Greatest (o-a)	*5*	39.76	35.78	43.23	*7*	40.16	30.49	55.38					*2*	40.4	34.5	46.29
	Least (d-b)	*5*	31.27	26.4	37.47	*7*	33.03	25.76	42.87					*2*	30.85	29.8	31.9
Humerus	Bd													*2*	61.53	61.53	61.53
	Bp																
	GL																
	SD																
Metacarpal	Bd	*3*	55.07	49	59.09					*2*	49.08	48.67	49.49	*3*	56.61	51.54	61.05
	Dd	*3*	28.94	24.96	31.3					*2*	27	26.84	27.15	*1*	31.13	31.13	31.13
	Bp	*4*	49.4	43.83	57.08	*2*	46.36	42.05	50.67	*2*	50.45	50.36	50.53	*3*	53.14	46.77	59.71
	GL									*1*	177	177	177	*2*	186.5	186	187
	SD									*1*	27.21	27.21	27.21	*2*	33.09	31.97	34.21
Metatarsal	Bd	*2*	50.05	42.72	57.37	*7*	49.08	42.43	53.17	*2*	45.6	43.82	47.38	*1*	59.53	59.53	59.53
	Dd	*2*	27.29	24.82	29.76	*5*	26.78	24.89	28.17	*1*	28.66	28.66	28.66				
	Bp	*3*	49.33	48.64	50.58	*4*	43.02	39.66	43.82	*3*	42.36	41.2	42.97	*1*	44.9	44.9	44.9
	GL					*2*	209.5	206	213	*1*	193	193	193				
	SD					*2*	25.51	24.92	26.1	*1*	21.65	21.65	21.65				
M3	Length	*6*	31.79	31.4	32.94	*3*	33.77	33.04	34.09	*1*	32.57	32.57	32.57	*2*	33.23	32.26	34.2
Radius	Bd					*1*	60.21	60.21	60.21								
	Bp	*1*	60.67	60.67	60.67	*1*	65.99	65.99	65.99								
	GL																
	SD																
Scapula	GLP					*1*	50.3	50.3	50.3	*1*	55.3	55.3	55.3				
Tibia	Bd	*3*	56.82	54.28	58.28	*3*	53.11	48.31	57.74								
	Bp																
	GL																
	SD																

TABLE 4.20: Summary of caprine measurements from Bartholomew Street East, with number of specimens, average, minimum and maximum measurements

Caprines		Phase 6				Phase 7				Phase 10				Phase R			
Element	Measurement	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.
Astragalus	GL1									1	29.2	29.2	29.2				
Femur	Bd	*1*	32.97	32.97	32.97												
	Bp																
	GL																
	SD																
Horncore	Greatest (o-a)	*2*	39.76	29.05	50.47	*2*	28.21	26.56	29.85								
	Least (d-b)	*2*	26.46	17.76	35.16	*2*	19.57	18.75	20,.9								
Humerus	Bd	*2*	28.11	27.97	28.24	*2*	27.44	25.88	28.99	3	29.62	25.5	33.87				
	Bp																
	GL																
	SD																
Metacarpal	Bd	*2*	23.72	23.46	23.98	*2*	23.03	22.4	23.66					*1*	23.8	23.8	23.8
	Dd	*2*	14.84	14.58	15.1	*2*	15.1	14.81	15.39					*1*	14.98	14.98	14.98
	Bp	*4*	21.41	19.37	22.66	*5*	20.98	19.5	23.35					*5*	20.69	18.74	22.58
	GL	*2*	124.07	120.65	127.48	*2*	116.89	111.08	122.7								
	SD	*2*	13.5	13.45	13.54	*2*	13.31	11.55	15.07								
Metatarsal	Bd	*4*	21.23	17.78	22.64	*3*	22.19	21.32	22.78								
	Dd	*3*	14.53	14.15	15.07	*3*	14.74	13.63	15.7								
	Bp	*4*	18.85	17.4	20.06	*3*	18.06	17.03	19.58								
	GL	*2*	126.71	116.7	136.71	*1*	117.77	117.77	117.77								
	SD	*2*	11.08	10.08	12.07	*1*	10.72	10.72	10.72								
M3	Length																
Radius	Bd	*1*	25.18	25.18	25.18	*2*	25.06	24.18	25.94	1	26.18	26.18	26.18				
	Bp	*4*	28.12	26.73	29.7	*3*	28.49	27.18	29.94	1	29.37	29.37	29.37				
	GL	*1*	131.88	131.88	131.88												
	SD	*1*	15.12	15.12	15.12												
Scapula	GLP	*3*	28.87	27.17	29.93	*2*	30.19	28.48	31.89	4	33.22	29.08	38.25	*1*	27.12	27.12	27.12
Tibia	Bd	*1*	25.71	25.71	25.71	*2*	24.27	24.22	24.32	1	36.1	36.1	36.1				
	Bp	*1*	36.76	36.76	36.76	*1*	37.05	37.05	37.05	1	25.6	25.6	25.6				
	GL																
	SD																

4.4 Bartholomew Street West (BSW)

RAMM accession number: 32/2005

Exeter archive site 47

Excavation year: 1974

South Quarter

4.4.1 Site description

The Bartholomew Street West excavations were undertaken in 1974 and produced material from Roman, medieval and post-medieval features. The site is located within the Roman City Wall in the west corner on the south side of St. Bartholomew's Cemetery. The earliest feature was a civil period kiln producing flagons and mortaria stamped VITANVS (Advisory Committee Report 1974). The site was terraced in the late 2^{nd} century to accommodate a timber building. By the late 3^{rd} century, domestic occupation had ceased as a large ditch or drainage feature was dug through the site. The medieval features – drains, a well, and rubbish pits – are almost all dated to the late 13^{th} century and likely associated with a Franciscan friary established in the area in c. 1240. The site was divided into two plots in the 17^{th} century, but there may have been one or more predecessors. In the late 17^{th} century a kiln was once again built, likely for clay-pipe making. It was short-lived, however, as the site was built over in the early 18^{th} century (Advisory Committee Report 1974).

4.4.2 The faunal remains

531 faunal specimens were recovered during the excavations, 209 of these were identifiable (Table 4.21). 144 of these specimens came from dated contexts. Nearly half are from phase 7, meaning that it is very difficult to draw any reliable conclusions or interpretations about the faunal material from the other phases due to the small amount of material (Table 4.21, 4.22, and 4.23). Phase 7 will be considered in the further results for the site, despite the low NISP, to give the reader some idea of the nature of the site.

Looking at the MAUs for phase 7, cattle and caprines are almost equally frequent, caprines only having two more units (Table 4.23). In comparison, pig only has a MAU

TABLE 4.21: Fragment counts by phase from Bartholomew Street West

Phase	NISP	Fish	Unidentifiable
2	25	-	46
3	10	-	18
7	63	-	61
8	19	-	14
10	8	-	13
R	11	-	30
M	8	-	14
Undated	65	-	126

TABLE 4.22: Fragment counts of species by phase from Bartholomew Street West

Species	2	3	7	8	10	R	M
Cattle	14	6	27	6	1	9	4
Sheep/goat	7	3	21	11	2	-	3
Pig	2	-	3	-	1	1	-
Sheep	-	-	2	-	-	-	1
Goat	-	-	2	-	-	-	-
Dog	-	-	1	-	-	-	-
Horse	-	1	1	-	-	-	-
Medium mammal	-	-	2	1	2	-	-
Large mammal	2	-	3	-	2	1	-
Domestic fowl	-	-	1	1	-	-	-

TABLE 4.23: MAU absolute counts of major domesticates by phase from Bartholomew Street West

Species	2	3	7	8	10	R	M
Cattle	7.25	4	21	3.5	1	9	3
Sheep/goat	5	2	23	3.5	2	-	4
Pig	1	-	1.5	-	1	-	-

of 1.5, suggesting that this species was only an occasional part of the diet at the site. The animals were clearly utilised for more than just meat, as over 40% of all identifiable specimens exhibit fresh fractures that are likely to be the result of fracturing the bones for marrow (Table 2.24 and Figure 4.18). As some of the specimens show signs of exposure to heat, it is possible that some of the specimens with dry fracture characteristics were fractured for marrow after being heated. Marks from carnivore gnawing were noted, so this may have resulted in dry fractures as well (Table 4.25). Dogs and other carnivores typically target the spongy ends of long bones, but the presence of carnivore gnawing at this site does not explain the patterns seen in the skeletal part abundances (Figure 4.19). Similar to other Exeter sites, late fusing epiphyses are missing indicating a recovery bias against smaller elements. This is supported by the lack of phalanges, astragali, and calcanei. If the lack of phalanges and other small bones is genuine, it appears as if lower legs, and in particular hind legs, were separated from the upper limbs in a different location. This is highlighted by tibiae having the highest frequencies, then only a small number of calcanei, followed by no metatarsals, suggesting that the leg was separated below the tibia. The relatively lower frequencies of femora indicated that the tibiae were brought to the site as a particular cut of meat. A similar pattern can be seen for the caprines, except that the preference is for the front limbs. As no scapulae are present, it is likely that the limb was separated from the torso either by separating it at the joint between the scapula and humerus, or, as there are no proximal humeri present despite the high frequency of shaft humeri, that the limb was separated below the humeral head. However, there is no butchery evidence to support either interpretation. Nine cases of butchery were recorded in phase 7 contexts on cattle and large mammal elements, five of these were on vertebral elements and the remaining on long bones.

Aging - fusion and dental wear: Only four stage 4 fusing elements were recovered from phase 7, one of these is caprine and the remaining three from cattle all of which are fused. Similarly, dental wear could only be recorded on three mandibles, two caprine (stage E and F), and one pig (stage C).

Sex: No specimens were suitable for recording of sex.

Metrics: Summaries of the measurements from caprines are presented in Table 4.26. Phases

TABLE 4.24: Fragmentation counts and FFI score from phase 7 at Bartholomew Street West

Fracture	Amount
Fresh	17
Fresh + dry	0
Fresh + dry + mineralised	0
Fresh + mineralised	0
Dry	10
Dry + mineralised	1
Mineralised	12
Impact scar	1
FFI score	3.3
New break	8
New break/NISP ratio	1:8

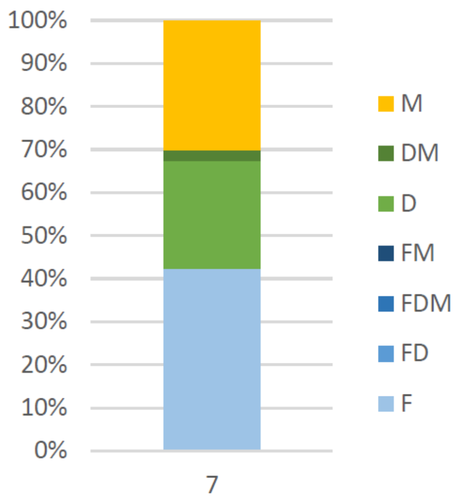


FIGURE 4.18: Fracture history profile for phase 7 from Bartholomew Street West

TABLE 4.25: Taphonomy absolute counts and frequencies from phase 7 at Bartholomew Street West

Type	Amount
Carnivore gnawing	3
Burning – singed	4
Burning – charred	1
Carnivore gnawing	4.8%
Burning - all	7.9%
Weathering score average	1.4

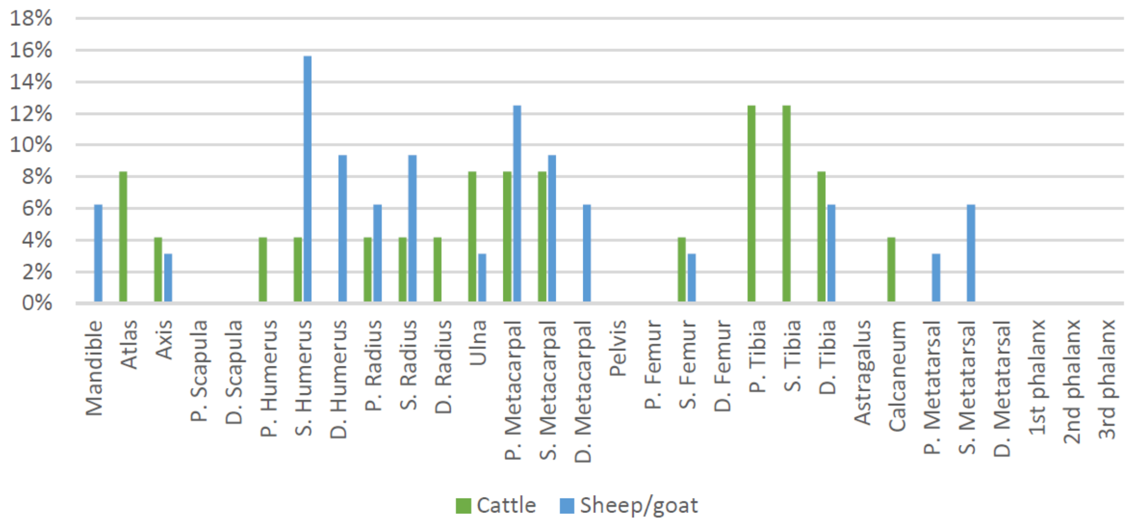


FIGURE 4.19: Cattle and caprine skeletal part abundances by MAU from phase 7 at Bartholomew Street West

with fewer than five measurements from a species have not been included which is why cattle and pigs are not present here.

TABLE 4.26: Summary of caprine measurements from Bartholomew Street West, with number of specimens, average, minimum and maximum measurements

Caprine		Phase 7			
Element	Measurement	*n*	Average	Min.	Max.
Astragalus	GLl				
Femur	Bd				
	Bp				
	GL				
	SD				
Horncore	Greatest (o-a)	1	43.2	43.2	43.2
	Least (d-b)	1	29	29	29
Humerus	Bd	3	26.33	24.9	27.3
	Bp				
	GL				
	SD				
Metacarpal	Bd	2	23.1	23	23.2
	Dd	2	14.4	13.7	15.1
	Bp	2	20.5	19.8	21.2
	GL	2	112.85	112	113.7
	SD	1	17.3	17.3	17.3
Metatarsal	Bd				
	Dd				
	Bp	1	19.1	19.1	19.1
	GL				
	SD				
M3	Length				
Radius	Bd				
	Bp	1	29.7	29.7	29.7
	GL				
	SD				
Scapula	GLP				
Tibia	Bd	2	23.6	23.4	23.8
	Bp				
	GL				
	SD				

4.5 The Deanery (EDST)

RAMM accession number: 422/2009

Exeter archive site 17

Excavation year: 2005-2006

East Quarter

4.5.1 Site description

The Deanery is a grade II listed building that lies within the Roman City Walls to the south-west of the Cathedral (Goodwin and Gent 2007). The excavations were undertaken by Exeter Archaeology during 2005 and 2006 prior to a change of use of the building. The building itself originates in the 13^{th} century, but has been extended and altered several times since then. The excavations revealed layers of intermingled Roman and post-medieval material, disarticulated human remains, above mixed Roman waste and material that may have been from the demolition of the Roman Bathhouse (Goodwin and Gent 2007). Faunal remains were found in the mixed Roman deposits, but, due to the nature of the stratigraphy, no closer date could be given.

4.5.2 The faunal remains

293 faunal remains were recovered during the excavations. 102 of these were identifiable, 2 were fish and the remaining 189 specimens could not be identified to species level(Table 4.27). All but one of the identifiable specimens are from the Roman period. Comparing the NISP and MAU counts it is apparent that, similar to almost all other sites, cattle bones are more fragmented than ones from caprines (Table 4.28 and Table 4.29). The NISP for the two species are the same, but the MAU for caprines is 43% whereas it is slightly lower for cattle at 39%. Both horse and pigeon/dove sp. are present as well, though in small numbers. Seven chicken specimens were identified from a minimum of two birds, but due to the broad dating it is difficult to say if they were a normal part of the Roman diet at this site. In terms of fragmentation, only about 10% of the NISP have fresh fracture characteristics and nearly 55% of the specimens had lost all their collagen when they were fractured resulting in mineralised fractures (Figure 4.20 and Table 4.30). The remaining

TABLE 4.27: Fragment count by phase from the Deanery

Phase	NISP	Fish	Unidentifiable
R	101	2	189
Undated	1	-	-

TABLE 4.28: Phase R fragment counts by species from the Deanery

Species	R
Cattle	30
Sheep/goat	30
Pig	16
Horse	2
Medium mammal	8
Large mammal	6
Domestic fowl	7
Pigeon/dove sp.	1

35% percent exhibit dry fractures, some of which may be explained by the carnivores gnawing on disposed bones, or having been exposed to heat (Table 4.31).

Skeletal part abundance: for cattle, the majority of the skeletal parts have frequencies between 4% and 9%, but unusually astragali represent 18% of all parts (Figure 4.21). As no other parts from the hind legs are present, aside from phalanges, it is difficult to determine why this element is so frequent, when normally they only occur in low numbers. Furthermore, the majority of the long bones (i.e. humerus, femur, tibia, and metatarsals) are missing as well. As it is not just the epiphyses that are absent, the lack of these bones cannot be explained by taphonomic processes or low MAUs, rather, human selection or deposition methods must have resulted in this pattern.

There has been a preference for the hind quarters of caprines as opposed to front quarters as all hind elements are at least twice as frequent as any of those from the front half

TABLE 4.29: Phase R MAU absolute counts and relative frequencies of major domesticates from the Deanery

Species	R	%
Cattle	16.75	39%
Sheep/goat	18.50	43%
Pig	7.75	18%

TABLE 4.30: Phase R fragmentation counts and FFI scores from the Deanery

Fracture	Amount
Fresh	3
Fresh + dry	2
Fresh + dry + mineralised	1
Fresh + mineralised	2
Dry	17
Dry + mineralised	10
Mineralised	41
Impact scar	0
FFI score	5.36
New break	10
New break/NISP ratio	1:10

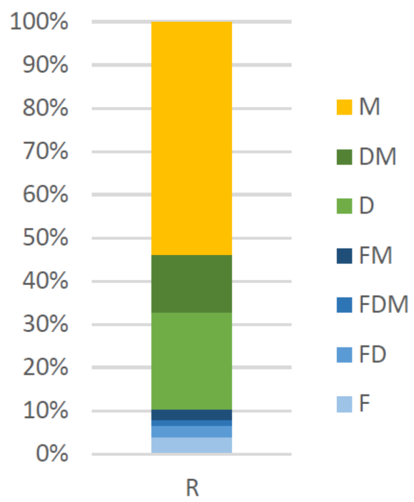


FIGURE 4.20: Phase R fracture history profile from the Deanery

TABLE 4.31: Phase R taphonomy absolute counts and frequencies from the Deanery

Type	Amount
Carnivore gnawing	5
Burning – singed	4
Carnivore gnawing	5%
Burning	4%
Weathering score average	1.8

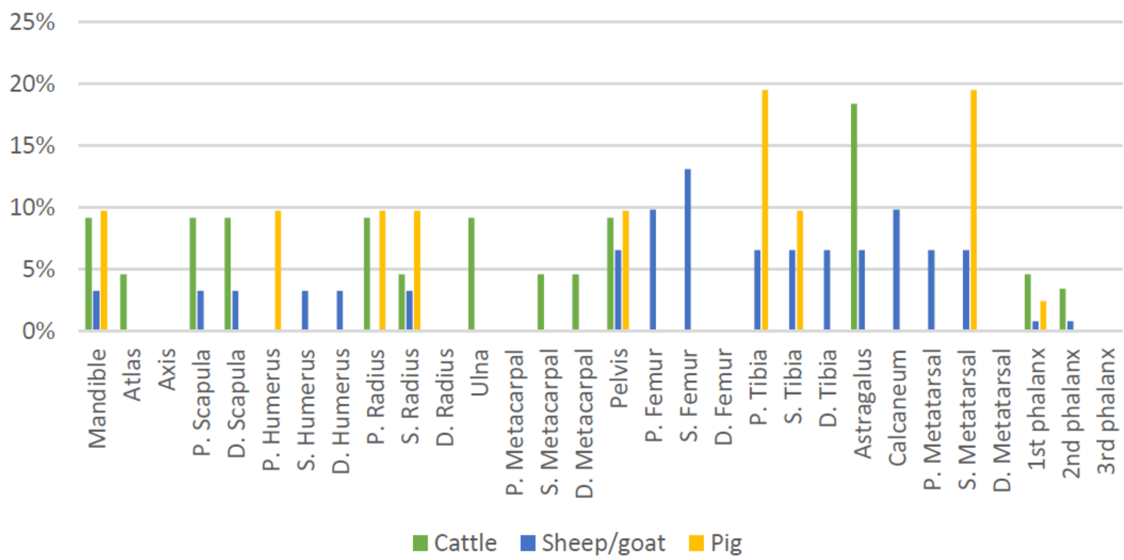


FIGURE 4.21: Phase R skeletal part abundances by MAU for major domesticates from the Deanery

of the animal. If these two halves are looked at separately, it looks as if the hind quarters were brought whole to the site and the less 'popular' front quarters were brought in as shoulders of meat with the upper half of the limb still attached but the lower limb detached. However, the butchery patterns do not support this interpretation as heads are present in equal numbers to the front limb parts, so, similar to cattle, the patterns are likely to be heavily influence by a human selection that is not easily determined.

The skeletal part abundances for pig are based on a MAU of only 7.75 so the representation may not be accurate. Based on the information that we do have, it looks like the whole body has been present, but with hind quarters being present in higher quantities than front quarter, similar to caprines (Figure 4.21).

Butchery: six cases of butchery were recorded, two on sheep/goat (femur and tibia), two on pig specimens (mandible and radius), and one on a cattle radioulna and the remaining one was located on a large mammal vertebra.

Aging - fusion and dental wear: 33% of stage 4 fusing caprine elements were fused, indicating that caprines were likely reared for a mix of meat and secondary products. Only a single pig element from this fusion stage was recovered, an unfused proximal tibia. No relevant cattle remains were present. No mandibles were suitable for recording of tooth wear.

Sex: No specimens were suitable for recording of sex.

Metrics: Only three specimens were suitable for taking measurements. All three were from caprines and comprise of one distal tibia (32 mm) and two astragali (15.6 and 22.5 mm).

4.6 Friernhay Street (FH)

RAMM accession number: 3/2005

Exeter archive site 75

Excavation year: 1981

West Quarter

4.6.1 Site description

The Friernhay Street excavations were undertaken prior to redevelopment of the site. It is a 1.3-acre area located within the Roman City Wall, over the defensive ditch surrounding the military Fortress, so the main focus of the works was to gain a better understanding of the fortress and the later Roman town (Advisory Committee Report 1981). Evidence of prehistoric occupation of the site was found in the form of a considerable number of worked flints of Late Neolithic/Early Bronze Age date, as well as some small features sealed beneath the pre-Roman turf level. The Roman military period features include a small defensive ditch that had been deliberately infilled prior to the construction of a larger outer ditch. 40 meters of the rampart was exposed, including two interval towers. The *intervallum* – the area between the back of the rampart and the inner perimeter street – showed early buildings and a later sequence of timber cookhouses with internal ovens. There was limited evidence for activity on the site in the Early Roman Town between AD 80 and 180/200. The large ditch remained open and was filled with stagnant water and the inner perimeter street – the *via sagularis* – was incorporated into the new street grid of *Isca Dumnoniorum* and resurfaced. Only a single building of unknown purpose belongs to the period. The layout of the excavated area changed considerably in the Later Roman Town (c. AD 180/200 - 400+) as the rampart was taken down and the ditch infilled with large quantities of domestic refuse. The former *via sagularis* went out of use and was replaced by a new road outside the old defences. Minimal information is available on the medieval and post-medieval periods, but we do know that three tenements were almost completely excavated (Advisory Committee Report 1981).

4.6.2 The faunal remains

A total of 9486 faunal specimens were recovered during the excavations, 2308 were identifiable mammal and bird specimens, 2546 were fish, and the remaining 4632 specimens could not be identified to species level (Table 4.32). The majority of the material is from phase 2 and the infilling of the large ditch. The large quantity of fish remains is due to two contexts being sieved, unfortunately, only the late 14^{th} century cess pit contained datable material. In terms of NISP, cattle are the most abundant out of all mammal species in all phases followed by caprines (Table 4.33 and Figure 4.22). Only in phase 1 and R are pig specimens more abundant than caprines. The amount of game declines over time, with only a few specimens being recovered occasionally after the Roman period and the same pattern is seen for horse. Except for phase 8, the amount of bird specimens varies little in relation to the total NISP for each phase. However, 45% of the total NISP for phase 8 is bird, most of these being domestic fowl and hawk species. The hawk specimens were recovered in close proximity to each other and are likely to be from three skeletons. The vast majority of specimens recorded as medium or large mammal are vertebral and rib fragments – medium mammal specimens corresponding to caprine and pig size and large mammal to cattle size. Medium mammal specimens are more abundant than large mammal ones in almost all phases suggesting that more elements of the torso from caprines and pigs are present at the site than those of cattle.

MAU: Cattle is the most frequent species in terms of MAU from the beginning of the Roman occupation until the late medieval period where caprines takes over (Figure 4.23, Table 4.34). During the Roman period, caprines began as the least frequent species, but numbers increased by about 20% by phase 6. Pigs have the opposite pattern to caprines, starting with being at its most frequent during the Roman period, but the amount decreases throughout time until it represents only 2% of the overall MAU in phase 10.

TABLE 4.32: Fragment counts by phase from Friernhay Street

Phase	NISP	Fish	Unidentifiable
1	280	-	834
2	839	1	1779
6	50	-	168
7	23	22	59
8	376	1625	476
9	130	1	164
10	99	-	101
R	239	1	466
PM	228	20	392
Undated	44	876	193

TABLE 4.33: Fragment counts of species by phase from Friernhay Street

Species	1	2	6	7	8	9	10	R	PM
Cattle	97	422	29	11	84	44	38	92	99
Sheep/goat	43	139	19	6	44	43	28	23	61
Pig	66	108	-	3	15	6	1	69	13
Sheep	-	7	-	-	-	2	7	2	3
Cat	-	1	-	-	18	-	-	-	-
Dog	16	26	-	-	-	1	-	3	1
Roe deer	-	3	-	-	1	-	-	-	-
Red deer	13	5	-	-	-	-	-	1	-
Wild boar cf.	3	-	-	-	-	-	-	-	-
Hare sp.	-	1	-	-	-	-	-	1	3
Rabbit	-	-	-	-	2	-	1	-	-
Horse	8	19	-	-	2	-	-	-	2
Rat sp.	-	-	-	-	7	-	-	-	-
Rat cf.	-	-	-	-	2	-	-	-	-
Small mammal	-	3	-	-	-	-	-	1	-
Medium mammal	14	48	-	2	25	16	14	42	14
Large mammal	14	37	2	1	8	8	7	4	18
Domestic fowl	6	18	-	-	131	9	1	1	8
Goose sp.	-	1	-	-	9	-	-	-	3
Mallard	-	-	-	-	-	-	1	-	1
Mallard cf.	-	-	-	-	-	1	-	-	-
Woodcock	-	-	-	-	-	-	-	-	1
Pigeon/dove sp.	-	-	-	-	2	-	-	-	-
Cormorant	-	-	-	-	-	-	1	-	-
Grey heron	-	-	-	-	1	-	-	-	-
Hawk sp.	-	-	-	-	23	-	-	-	-
Raven	-	1	-	-	-	-	-	-	-
Jackdaw	-	-	-	-	-	-	-	-	1
Avian	-	-	-	-	2	-	-	-	-
Medium bird	-	-	-	-	1	-	-	-	-

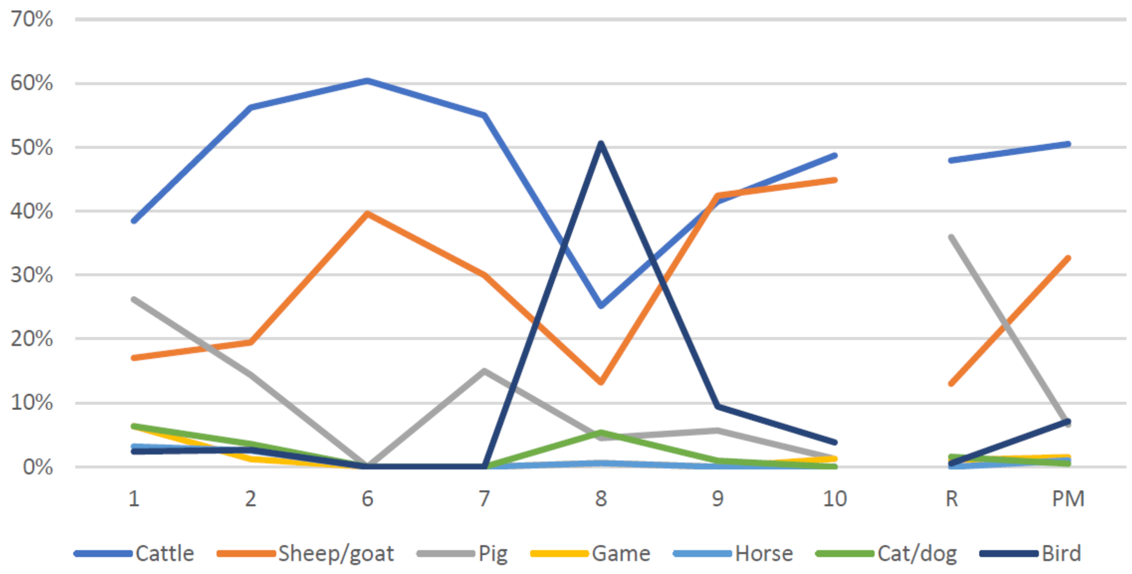


FIGURE 4.22: Frequencies of species and groups by phase from Friernhay Street

TABLE 4.34: MAU absolute counts and relative frequencies of major domesticates by phase from Friernhay Street

	1	2	8	9	10	R	PM
Cattle	60.25	262.5	36.5	27.75	20.75	70	57
Sheep/goat	32	115	37.25	36.25	28	19	48
Pig	39	76	9.75	4	1	32.5	9
Cattle %	46	58	44	41	42	58	50
Sheep/goat %	24	25	45	53	56	16	42
Pig %	30	17	12	6	2	27	8

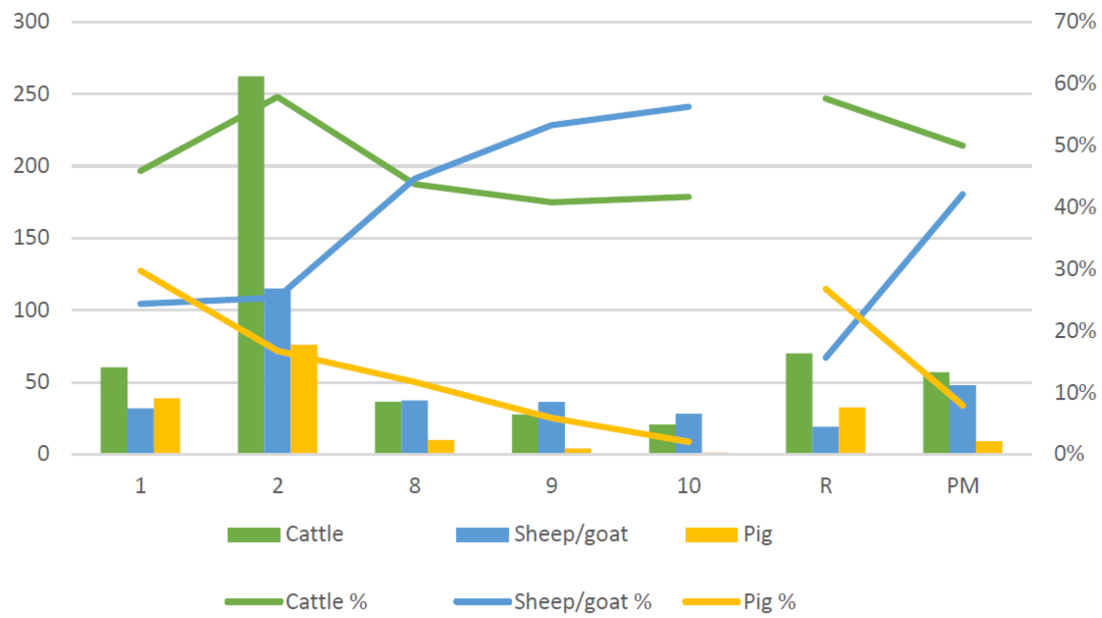


FIGURE 4.23: MAU absolute counts (primary axis) and relative frequencies (secondary axis) of major domesticates by phase from Friernhay Street

TABLE 4.35: Fragmentation counts and FFI scores by phase from Friernhay Street

Fracture	1	2	8	9	10	R	PM
Fresh	28	150	17	24	21	35	42
Fresh + dry	0	2	0	1	0	0	1
Fresh + dry + mineralised	0	0	0	0	0	0	0
Fresh + mineralised	2	3	1	0	3	1	4
Dry	26	84	8	10	6	24	16
Dry + mineralised	0	1	0	1	0	2	3
Mineralised	31	186	45	24	20	47	35
Impact scar	0	9	0	1	0	1	1
FFI score	3.7	3.8	4.5	3.5	3.6	3.8	3.3
New break	41	100	9	7	9	22	15
New break/NISP ratio	1:7	1:8	1:42	1:19	1:11	1:7	1:15

Fragmentation: There are three groups of fragmentation patterns that correlate with the historic periods (Figure 4.24, Table 4.35). The Roman period has the most even ratios between fresh, dry and mineralised first fractures in all three phases. Fresh fractures are present on around 35% of all specimens, dry fractures on 20-30% and mineralised fractures on 35-45%. The trend for the three post-medieval phases is very similar, though with less variation between phases. Fresh fractures are the most frequent with 40-45%, dry fractures the least frequent with 15-20% and mineralised at 35-40%. The medieval period shows the greatest variation, however, phase 6 and 7 also have the smallest NISPs (respectively 50 and 23), so the patterns for these two phases may not be representative of the whole time brackets they represent. Nonetheless, the three medieval phases all show the lowest amounts of fresh fractures and the highest of mineralised fractures, out of all phases which is also reflected in the higher FFI scores (Table 4.35). The changing trends between the time periods suggest that the amount of marrow consumption was steadfast but subject to major cultural shifts.

Taphonomy: The amount and type of taphonomy appears to be unrelated to the NISP for the individual phases (Table 4.32, Table 4.36). This is particularly evident when looking at signs of burning. In the two phases with the highest NISP, phase 2 and 8, there are signs of burning on respectively 11% and 22.9% of all specimens, whereas phase R, 6, 7, 9, 10 and PM only have a few standalone cases regardless of NISP. The same lack of correlation is true for carnivore gnawing. This trend, or the lack thereof, suggests that taphonomic

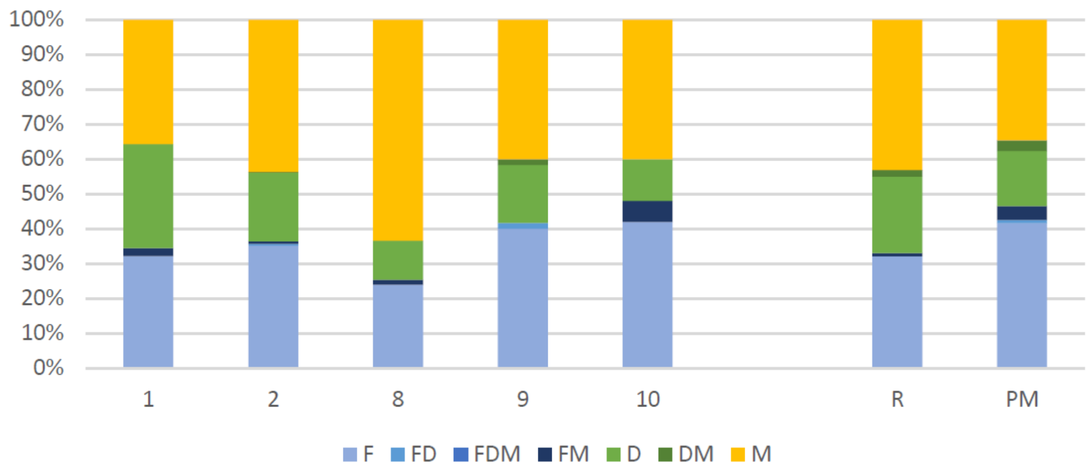


FIGURE 4.24: Fracture history profiles by phase from Friernhay Street

factors affecting the bones are highly variable throughout time and are unrelated to time period or assemblage size. Furthermore, excavation technique does not affect the amount of taphonomy identified. Looking at the new break/NISP ratio (Table 4.35) it is apparent that excavators were less careful working through the later phases, but getting towards the Roman deposits more care was taken and fewer bones were broken (Table 4.35). The reason for the high proportion of burnt specimens in phase 8 primarily stems from a single context. An early 14^{th}-century pit containing mainly domestic fowl, the majority of which had evidence of exposure to heat, accounts for 82 out of the 86 cases of burning. This demonstrates that even though a much higher ratio of taphonomy is present in some phases, it is not indicative of an overall increase in e.g. exposure to heat, but rather that single contexts can greatly influence our interpretation of general trends.

Skeletal part abundance: The skeletal part abundances for cattle, caprines, and pigs are presented in Figure 4.25, 4.26, and 4.27. The data from phase 7, as well as the pig data from phase 6, 9, and 10, have not been included as the MAU are too low to give a reliable distribution. Overall, the whole body appears to be present for all species in all phases, though there was a likely recovery bias against small elements and the later fusing epiphyses of long bones. Though, the seemingly quicker excavation of the later phases (see Taphonomy above), does not appear to have had a visible influence on this bias. Carnivore gnawing may also have contributed to the lower amounts of epiphyses relative to shafts, particularly in phase 2, R, and PM (Table 4.36).

FIGURE 4.25: Cattle skeletal part abundances by MAU by phase from Friernhay Street

TABLE 4.36: Taphonomy absolute counts and frequencies by phase from Friernhay Street

Type	1	2	8	9	10	R	PM
Carnivore gnawing	4	44	3	1	4	10	13
Rodent gnawing	-	-	-	3	-	-	-
Digestion	-	-	-	-	-	-	-
Insect damage	-	-	-	-	-	1	-
Staining	-	1	-	-	-	-	-
Burning – singed	22	78	80	2	-	-	-
Burning – charred	-	13	6	1	-	1	1
Burning – calcined	-	1	-	-	-	-	-
Carnivore gnawing	1.4%	5.2%	0.8%	0.8%	4.0%	4.2%	5.7%
Burning (all)	7.9%	11.0%	22.9%	2.3%	-	0.4%	0.4%
Weathering score	2.1	2.1	2	2	2	2.1	2.1

For cattle, in the beginning of the Roman period (phase 1) there is a clear selection for mandibles, metapodia and radii at the site (Figure 4.25). Though, in the following phase, the pattern changes and the front quarters are more prevalent with humeri and ulnae being the most frequent. This pattern is also seen in the phase for the whole Roman period (phase R) though, with a more even selection between the front and hind quarters. Moving into the medieval period, the patterns for phase 6 and 8 are very similar as well with metapodia having the highest numbers. In phase 6 mandibles are as frequent as metapodia, and phase 8 sees the highest frequencies of phalanges suggesting that deposits from this phase are likely to contain mainly butchery waste, though the presence of other long bones indicate that they are mixed deposits with food waste as well. Furthermore, the same pattern is seen in the general post-medieval phase, though not in phase 9 and 10. In phase 9, metatarsals are still the most abundant, but there is a more even amount of the upper front limb, and in phase 10 there is an almost even distribution of elements.

Caprine mandibles are more frequent than any other element in phase 1 and 2 and humeri, radii, and metatarsals follow with the addition of tibiae in phase two (Figure 4.26). The general Roman phase also has mandibles as one of the most frequent elements, but here it is along with tibiae and metatarsals, the latter being the most abundant. By phase 6 the pattern has changed completely, and radii now dominate, with all other parts, apart from 1st phalanges, present in equal quantities. By the late medieval period (phase 8), the pattern has changed again. Scapulae, humeri, and tibiae are the most frequent

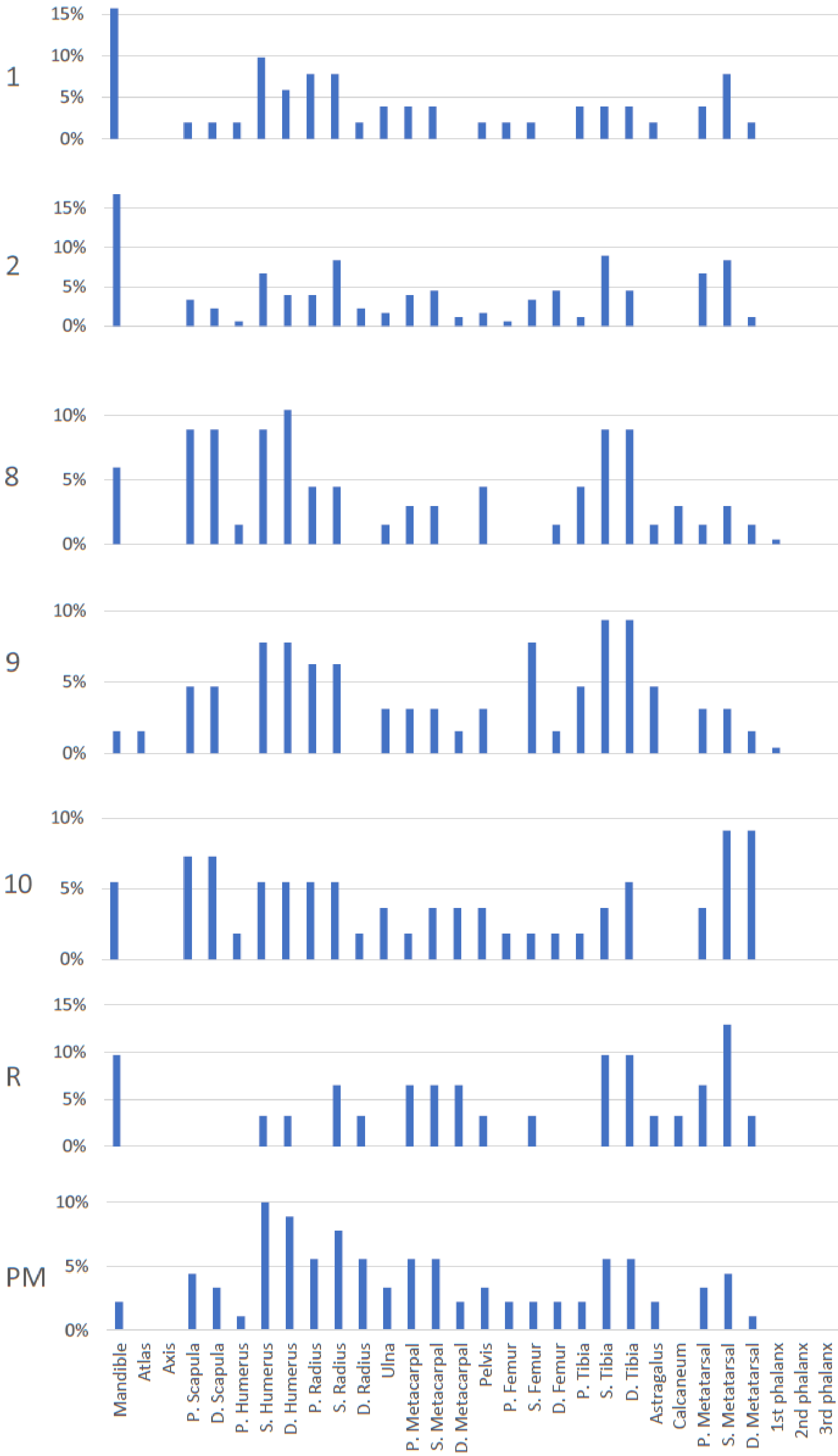


FIGURE 4.26: Caprine skeletal part abundances by MAU by phase from Friernhay Street

elements, suggesting a selection for the meatier parts of the animal, a trend that continues into the post-medieval phases. In phases 10 and PM, most elements are fairly evenly represented, suggesting whole animals were brought to the site, though with additional scapulae and metatarsals in phase 10 and what appears to be a preference for humeri in phase PM.

As mentioned above, there is only sufficient pig material to assess skeletal part abundances for five phases (Figure 4.27). Similar to the caprines, mandibles appear to be the, or among the, most frequent elements in all three Roman phases. In phase 1 mandibles are followed by scapulae and radii, and in phase 2 pelves, though all other elements are relatively evenly represented. Mandibles still make up over 15% of the phase 8 material, but ulnae dominate with over 25%, and interestingly there are no identified radii as one would expect. However, the total MAU for pigs in phase 8 is 9.75, so this pattern may not be representative of the whole phase for this site (Table 4.6.3). While the MAU for phase PM is low as well, the trend is more similar to what we see for caprines with a fairly even representation for the long bones.

Butchery: Only phase 2 cattle have enough butchery marks to be included here (Figure 4.28, 4.29, and 4.30). Almost all butchery marks are present on the front limbs. The chop marks on proximal ends and blades of scapulae are consistent with trimming in preparation for smoking of the shoulder, and the ones around the humerus-radius-ulna joint are likely from separating the limb into joints of meat. The chop marks around the bases of horncores are likely to be related to horn crafts. Cutmarks are located in two places on the lower limbs. The ones on the front leg circulate the shaft of the metacarpal and are consistent with removal of the hide. The cut marks on the hind leg are located at the joint between the 1st phalanx and the metatarsal which may be be from removing the hoof from the lower leg.

Aging - fusion: The relative proportions of stage 4 fused and unfused elements in cattle, caprines, and pigs show clear differences in the slaughter ages. Stage 4 is the final fusion stage, so the data presented in Figure 4.31, 4.32, and 4.33 show the proportion of animals that had fully fused skeletons against the ones that died before this stage. Figure 4.33 shows that almost all pigs throughout these time periods were killed before they reached

FIGURE 4.27: Pig skeletal part abundances by MAU by phase from Friernhay Street

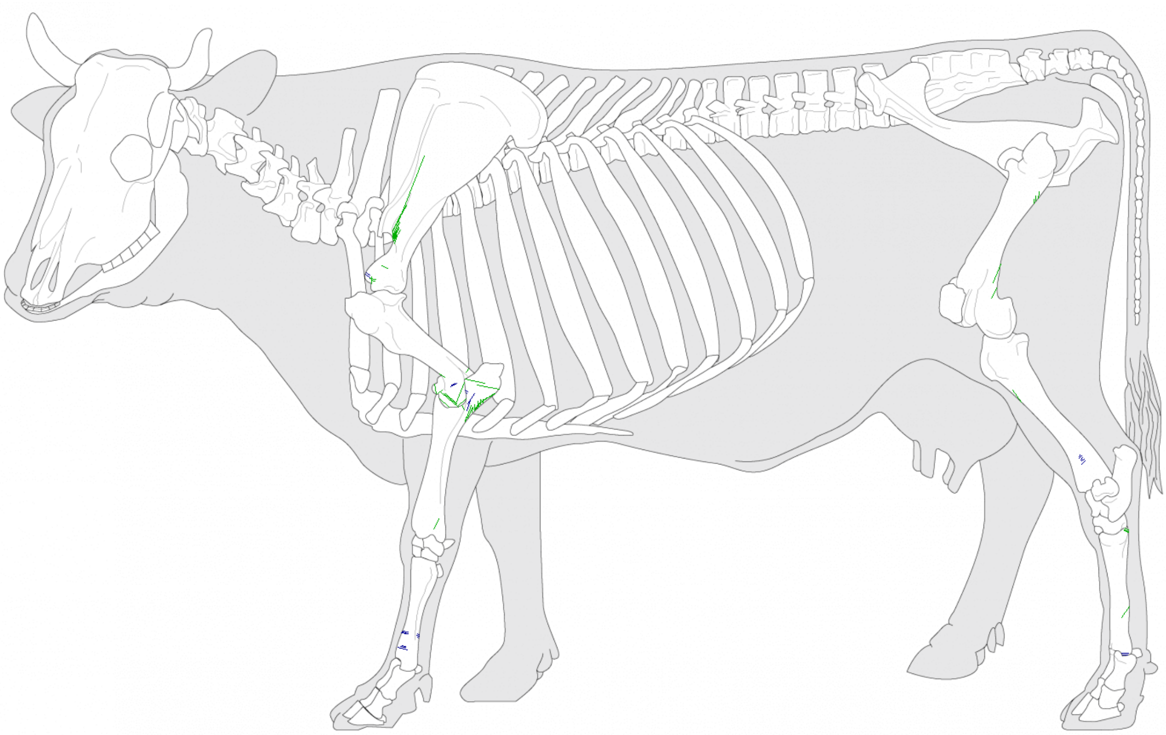


FIGURE 4.28: Cattle butchery from phase 2 at Friernhay Street. Key: green - chop; blue - cut

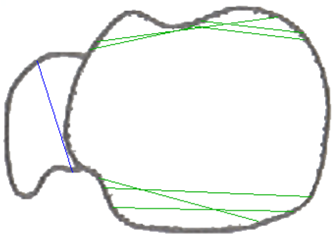


FIGURE 4.29: Cattle proximal scapula butchery from phase 2 at Friernhay Street. Key: green - chop; blue - cut

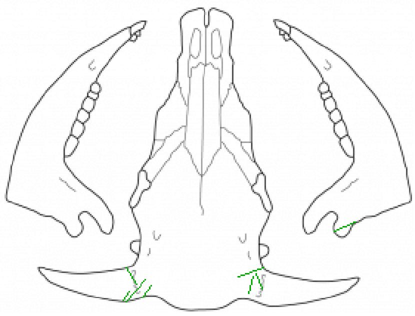


FIGURE 4.30: Cattle skull butchery from phase 2 at Friernhay Street. Key: green - chop; blue - cut

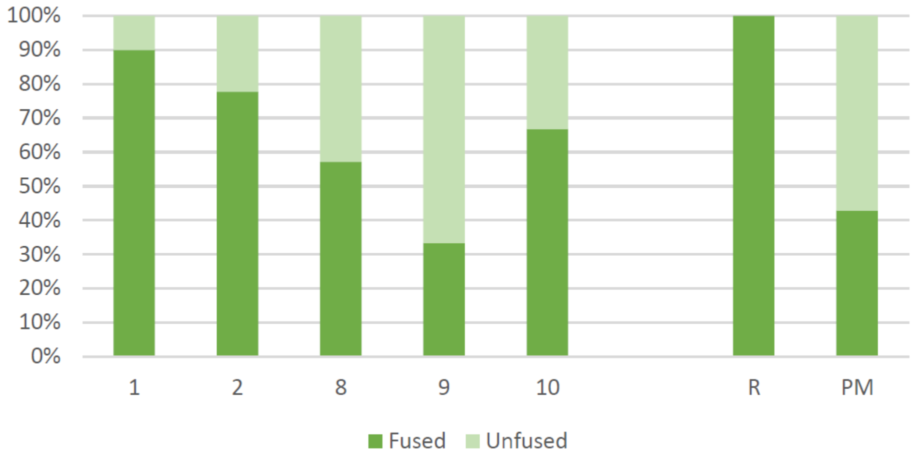


FIGURE 4.31: Stage 4 cattle fusion by phase from Friernhay Street

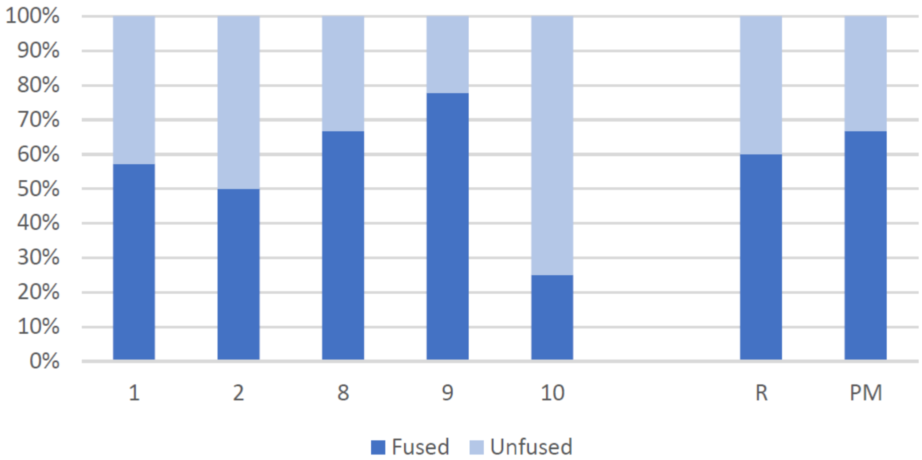


FIGURE 4.32: Stage 4 caprine fusion by phase from Friernhay Street

full skeletal maturity suggesting that they were reared for meat. Cattle and caprines, on the other hand, show different trends throughout time. Almost all cattle survived past stage 4 in the Roman phases suggesting that they were kept for secondary products, but were then kept for both meat and secondary products in the remaining phases, with meat being the primary focus in phase 9 (Figure 4.31). Caprines were reared for both meat and secondary products in all phases, but the focus varies (Figure 4.32). In phase 9 the primary focus is secondary products, whereas in phase 10 meat is clearly the priority. *Aging - dental wear*: Table 4.37, 4.38, and 4.39 present absolute counts for the number of mandibles of cattle, caprines, and pigs at each wear stage. There are too few data to draw broad interpretations, but for all species most mandibles have wear stages between E and G suggesting that most cattle survived past 30 months, caprines past 24 months, and pigs

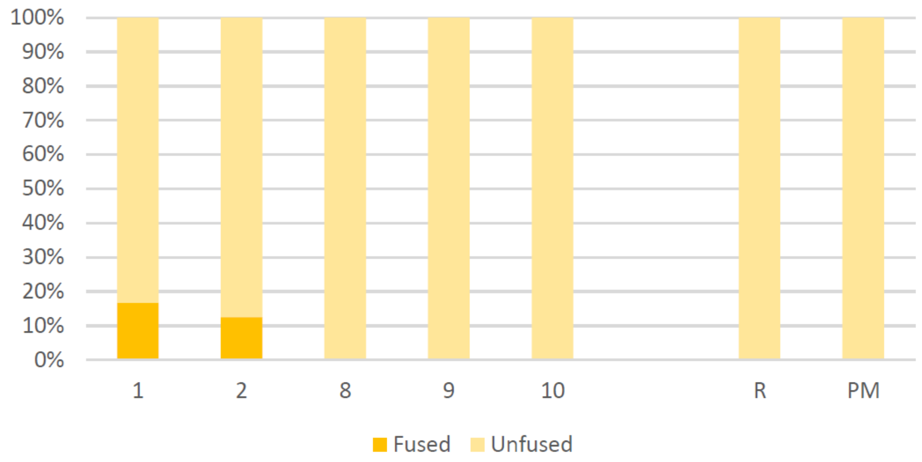


FIGURE 4.33: Stage 4 pig fusion by phase from Friernhay Street

TABLE 4.37: Cattle tooth wear by phase from Friernhay Street

Wear stage	1	2	8	9	10	R	PM
A	-	-	-	-	-	-	-
B	-	-	-	-	-	-	-
C	-	-	-	-	-	-	-
D	-	-	-	-	-	-	-
E	3	2	-	-	-	-	-
F	-	1	-	-	-	-	-
G	6	2	-	-	-	1	-
H	4	1	-	-	-	-	-
I	-	2	-	-	-	-	-

past 'young adult'.

Sex: Table 4.20 presents the absolute counts for identified male and female cattle, caprines, and pigs. For the phases and species where data are present, males and females are fairly evenly represented, though these trends may be heavily biased by the difficulties in identifying sex in faunal remains.

Metrics: Summaries of the measurements from cattle, caprines and pigs are presented in Table 4.41, 4.42, 4.43 and 4.44. Phases with fewer than five measurements from a species have not been included here.

TABLE 4.38: Caprine tooth wear by phase from Friernhay Street

Wear stage	1	2	8	9	10	R	PM
A	-	-	-	-	-	-	-
B	1	1	-	-	-	1	-
C	-	-	-	-	-	-	-
D	-	6	-	-	-	-	-
E	1	4	-	-	-	-	-
F	1	5	1	-	-	1	-
G	2	-	-	1	3	-	-
H	-	-	-	-	-	-	-
I	1	-	-	-	-	-	-

TABLE 4.39: Pig tooth wear by phase from Friernhay Street

Wear stage	1	2	8	9	10	R	PM
A1	-	-	-	-	-	-	-
A2	-	-	-	-	-	-	-
A3	-	-	-	-	-	-	-
B	-	2	-	-	-	-	-
C	-	-	-	-	-	1	-
D	-	-	-	-	-	-	-
E	1	2	1	-	-	1	-
F	-	5	-	-	-	2	-
G	-	1	-	-	-	-	-

TABLE 4.40: Absolute counts of sex for major domesticates from Friernhay Street

		1	2	8	9	10	R	PM
Cattle	Male	-	1	-	-	-	1	-
	Female	-	1	-	1	-	1	-
Caprines	Male	-	1	-	-	-	-	-
	Female	-	1	-	1	-	-	1
Pig	Male	1	4	-	1	-	4	-
	Female	-	3	2	1	-	2	-

TABLE 4.41: Summary of cattle measurements from Friernhay Street, with number of specimens, average, minimum and maximum measurements

Cattle		Phase 1				Phase 2				Phase 6				Phase 8				Phase 9			
Element	Measurement	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.
Astragalus	GL1					2	59,38	59,15	59,6												
Femur	Bd																				
	Bp																				
	GL																				
	SD																				
Horncore	Greatest (o-a)	1	35,98	35,98	35,98	17	41,89	30,92	63,43					2	35,67	31,82	39,51				
	Least (d-b)	1	26,39	26,39	26,39	17	30,09	23,28	42,03					2	24,92	20,84	29				
Humerus	Bd					1	71,26	71,26	71,26					1	89,24	89,24	89,24				
	Bp																				
	GL																				
	SD																				
Metacarpal	Bd	6	49,33	48,05	52,52	13	49,98	46,61	57,7	1	54,9	54,9	54,9								
	Dd	4	28,05	26,24	29,54	11	26,67	25,8	29,73	1	27,93	27,93	27,93								
	Bp	7	50,85	45,75	58,15	8	48,18	44,76	52,59	2	52,98	51,86	54,1	4	56,75	51,48	59,24	1	59,74	59,74	59,74
	GL	2	171,75	171	172,5	2	167,25	167	167,5												
	SD	2	27,08	26,74	27,42	2	26,08	25,92	26,24												
Metatarsal	Bd	2	45,51	44,77	46,25	16	44,73	39,36	50,24	1	48,61	48,61	48,61					6	53,1	44,59	58,14
	Dd	2	26,48	24,37	28,58	14	26,48	24,62	28,67	1	28,28	28,28	28,28					6	30,09	25,47	33,29
	Bp	2	39,68	39,02	40,34	14	42,76	39,69	50,06	2	47,07	41,05	53,08	4	46,91	39,83	51,86	3	49,78	46,21	52,22
	GL	1	187	187	187	2	200	197	203	1	210	210	210	1	230	230	230	4	224,38	195	243,5
	SD	1	20,68	20,68	20,68	2	22,28	21,71	22,84	1	22,5	22,5	22,5	1	33,08	33,08	33,08	4	28,39	23,57	31,68
M3	Length					8	33,74	31,16	36,53	1	36,51	36,51	36,51	2	36,6	36,13	37,07				
Radius	Bd	2	58,73	57,55	59,9	1	60,37	60,37	60,37												
	Bp													1	69,17	69,17	69,17	2	73,75	73,62	73,87
	GL	1	239	239	239	1	240	240	240												
	SD	1	32,84	32,84	32,84	1	33,38	33,38	33,38												
Scapula	GLP					4	57,53	53,03	62,87												
Tibia	Bd					1	53,13	53,13	53,13					1	51,84	51,84	51,84	1	67,43	67,43	67,43
	Bp																				
	GL																				
	SD																				

TABLE 4.42: Summary of cattle and caprine measurements from Friernhay Street, with number of specimens, average, minimum and maximum measurements

		Cattle - Phase 10				Cattle - Phase R				Cattle - Phase PM				Caprines - Phase 1				Caprines - Phase 2			
Element	Measurement	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	n	Average	Min.	Max.
Astragalus	GL1									*1*	70,42	70,42	70,42								
Femur	Bd									*1*	89,41	89,41	89,41					*1*	36,01	36,01	36,01
	Bp																				
	GL																				
	SD																				
Horncore	Greatest (o-a)					*11*	40,97	30,12	49,96									*1*	35,28	35,28	35,28
	Least (d-b)					*11*	28,79	23,71	34,94									*1*	24,76	24,76	24,76
Humerus	Bd	*1*	86,68	86,68	86,68									*2*	26,4	24,81	27,99	*3*	26,59	25,96	27,27
	Bp																				
	GL																				
	SD																				
Metacarpal	Bd					*2*	47	45,33	48,67	*4*	54,56	51,59	59,47					*1*	22,88	22,88	22,88
	Dd					*2*	26,63	25,88	27,37	*3*	29,74	28,18	30,76					*1*	14,53	14,53	14,53
	Bp	*2*	62,7	57,49	67,9	*2*	51,12	47	55,23	*10*	56,04	49,24	65,77					*3*	20,52	19,94	21,14
	GL									*4*	189,38	172,5	199,5					*2*	128,03	124,39	131,66
	SD									*4*	30,46	29,86	40,79					*2*	12,34	12,09	12,58
Metatarsal	Bd	*1*	63,06	63,06	63,06	*1*	43,52	43,52	43,52	*6*	48,17	41,03	51,77	*1*	23,25	23,25	23,25	*1*	20,61	20,61	20,61
	Dd	*1*	36,32	36,32	36,32	*1*	26,74	26,74	26,74	*5*	27,42	24,07	28,7	*1*	14,88	14,88	14,88	*1*	13,48	13,48	13,48
	Bp					*1*	41,52	41,52	41,52	*5*	47	44,25	50,33					*8*	17,66	15,56	19,15
	GL					*1*	193	193	193	*3*	206,83	204,5	211					*1*	120,95	120,95	120,95
	SD					*1*	23	23	23	*3*	23,55	23,18	24,12					*2*	10,14	9,98	10,29
M3	Length									*1*	35,43	35,43	35,43								
Radius	Bd	*1*	82	82	82									*1*	24,34	24,34	24,34	*3*	25,06	23,4	27,6
	Bp					*1*	67,27	67,27	67,27	*1*	88,4	88,4	88,4	*1*	26,85	26,85	26,85	*5*	25,32	16,01	30,26
	GL					*1*	243	243	243									*2*	128,56	120,76	136,36
	SD					*1*	32,79	32,79	32,79									*1*	13,52	13,52	13,52
Scapula	GLP									*1*	87,31	87,31	87,31					*2*	28,42	27,77	29,06
Tibia	Bd					*1*	53,3	53,3	53,3					*1*	22,55	22,55	22,55	*5*	22,42	21,36	23,66
	Bp																				
	GL																				
	SD																				

TABLE 4.43: Summary of caprine measurements from Friernhay Street, with number of specimens, average, minimum and maximum measurements

Caprines		Phase 6				Phase 8				Phase 9				Phase 10				Phase PM			
Element	Measurement	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.
Astragalus	GL1									2	28,86	27,9	29,82					1	26,68	26,68	26,68
Femur	Bd	1	32,12	32,12	32,12	1	35,3	35,3	35,3	1	34,32	34,32	34,32					1	37,58	37,58	37,58
	Bp													1	37,69	37,69	37,69				
	GL																				
	SD																				
Horncore	Greatest (o-a)																				
	Least (d-b)																				
Humerus	Bd	1	27,56	27,56	27,56	5	27,83	26,52	29,39	3	29,06	27,71	29,95	2	30,65	29,14	32,16	6	27,37	23,09	29,78
	Bp																				
	GL																				
	SD																				
Metacarpal	Bd									1	24,94	24,94	24,94	2	25,33	23,53	27,13	2	24,18	23,23	25,13
	Dd									1	16,16	16,16	16,16	2	14,97	14,29	15,64	1	13,73	13,73	13,73
	Bp	1	21,15	21,15	21,15	2	20,21	19,97	20,45	2	22,88	22,25	23,5	1	21,28	21,28	21,28	5	21,53	19,74	23,32
	GL	1	111,27	111,27	111,27					1	130,19	130,19	130,19	1	120,83	120,83	120,83	2	112,87	100,52	125,21
	SD	1	12,63	12,63	12,63					1	13,86	13,86	13,86	1	12,83	12,83	12,83	2	13,67	12,78	14,55
Metatarsal	Bd					1	20,32	20,32	20,32	1	24,88	24,88	24,88	5	25,12	22,87	27,37				
	Dd					1	14,27	14,27	14,27	1	16,03	16,03	16,03	5	16,19	14,37	18,94				
	Bp									2	20,32	20,31	20,32	1	19	19	19	1	19,18	19,18	19,18
	GL									1	127,53	127,53	127,53	1	118,22	118,22	118,22				
	SD									1	13,52	13,52	13,52	1	11,89	11,89	11,89				
M3	Length																				
Radius	Bd													1	27,36	27,36	27,36	4	26,82	24,52	30,01
	Bp	1	30,2	30,2	30,2	2	30,81	29,65	31,97	3	29,83	27,19	33,67	3	29,76	28,66	31,08	3	27,57	25,91	28,63
	GL													1	139,58	139,58	139,58	3	129,22	121,82	135,27
	SD													1	15,82	15,82	15,82	3	14,8	13,31	15,57
Scapula	GLP	1	34,67	34,67	34,67	4	30,67	30,28	31,18	1	29,66	29,66	29,66	3	32,36	29,96	33,78	3	33,49	30,7	36,81
Tibia	Bd	1	25,55	25,55	25,55	5	23,94	22,51	25,11	5	25,15	24,35	26,84	3	24,55	23,38	25,39	3	23,84	21,86	25,09
	Bp	1	36,23	36,23	36,23					1	39,98	39,98	39,98								
	GL																				
	SD																				

TABLE 4.44: Summary of pig measurements from Friernhay Street, with number of specimens, average, minimum and maximum measurements

Pig		Phase 10				Phase PM			
Element	Measurement	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.
Astragalus	GL1					*1*	37,4	37,4	37,4
Femur	Bd								
	Bp								
	GL								
	SD								
Horncore	Greatest (o-a)								
	Least (d-b)								
Humerus	Bd					*1*	40,13	40,13	40,13
	Bp								
	GL								
	SD								
Metacarpal	Bd								
	Dd								
	Bp								
	GL								
	SD								
Metatarsal	Bd								
	Dd								
	Bp								
	GL								
	SD								
M3	Length								
Radius	Bd								
	Bp	*4*	30,51	27,57	35,72	*2*	27,54	25,98	29,1
	GL								
	SD								
Scapula	GLP	*2*	32,6	31,28	33,91	*1*	33,5	33,5	33,5
Tibia	Bd	*1*	33,51	33,51	33,51	*2*	28,24	26,06	30,42
	Bp								
	GL								
	SD								

TABLE 4.45: Fragment counts by phase from Good Shepherd Hospital

Phase	NISP	Fish	Unidentifiable
9	91	-	37
Undated	1	-	-

4.7 Good Shepherd Hospital (GSH)

RAMM accession number: 362/2006

Exeter archive site 70

Excavation year: 1979

Extramural

4.7.1 Site description

The trial excavations at Good Shepherd Hospital were undertaken in 1979. They were located outside the Roman City wall along what is likely to have been the main road out of the South Gate (Advisory Committee Report 1979). Some human remains were recovered which may have been from a late Roman cemetery. However, all other Roman deposits in the area had been removed by 16^{th} century terracing. A pit and ditch were the only features that provided enough pottery to give context dates. The features have been dated to 1610-30 (Advisory Committee Report 1979).

4.7.2 The faunal remains

129 specimens were analysed from the Good Shepherd Hospital excavations. 92 of these were identifiable and the remaining 37 could not be assigned a species (Table 4.45). 91 of the NISP are from phase 9 and a single specimen is from an undated context. According to the NISP cattle is the most prevalent species, however, the MAU shows that caprines make up nearly 54% of the total units (Table 4.46 and Table 4.47). Approximately 60% of all identifiable specimens have fresh fractures (Figure 4.34). At least some of these are human made as impact scars are visible on four specimens, though, over a quarter of the bones have marks from carnivore gnawing so some fresh fractures may have been caused by animals (Table 4.48, Table 4.49 and Figure 4.35).

TABLE 4.46: Fragment counts of speciesby phase from Good Shepherd Hospital

Species	9
Cattle	41
Sheep/goat	31
Pig	3
Sheep	5
Horse	1
Medium mammal	1
Large mammal	9

TABLE 4.47: MAU absolute counts and relative frequencies of major domesticates in phase 9 from Good Shepherd Hospital

Species	9	%
Cattle	27.5	44.7%
Sheep/goat	33	53.7%
Pig	1	1.6%

TABLE 4.48: Phase 9 fragmentation counts and FFI score from Good Shepherd Hospital

Fracture	Amount
Fresh	28
Fresh + dry	0
Fresh + dry + mineralised	0
Fresh + mineralised	0
Dry	7
Dry + mineralised	0
Mineralised	11
Impact scar	4
FFI score	2.4
New break	18
New break/NISP ratio	1:5

TABLE 4.49: Phase 9 taphonomy absolute counts and relative frequencies from Good Shepherd Hospital

Type	Amount
Carnivore gnawing	24
Carnivore gnawing	26.4%
Weathering score average	1.4

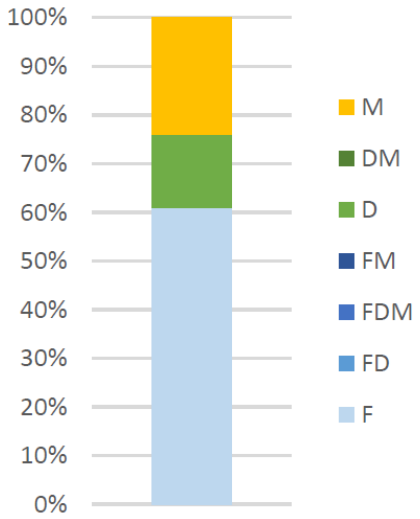


FIGURE 4.34: Phase 9 fracture history profile from Good Shepherd Hospital

Skeletal part abundance: The skeletal part abundances for cattle and caprines are presented in Figure 4.35. Pig has not been included as only a single tibia was identified and the remaining two specimens are canines. There appears to have been a recovery bias against small elements and possibly late fusing elements. Shafts are also represented in higher frequencies which may be an effect of the carnivore gnawing (Table 4.49). In cattle, nearly all parts are present in almost equal numbers except for three parts. Shaft and distal humeri, and shaft tibiae in much higher frequencies, in particular the former two indicating a human selection for meat-bearing elements. Caprines parts, on the other hand, have a high frequency of metapodia especially metatarsals. Humeri, femora and metacarpals occur in similar amounts, suggesting that the metatarsals were brought to the site as individual elements rather than connected with upper limbs.

Butchery: 15 of the 41 cattle specimens have butchery marks on them which can be seen in Figure 4.36. Nine cases of butchery are located on the humerus, in particular on the distal shaft suggesting that they were separating the animal into smaller parts; rather than dividing it at the joint, they were going through the shaft above the joint.

Aging - fusion and dental wear: The relative proportions of stage 4 fused and unfused elements in cattle and caprines are shown in Figure 4.37. No data are available for pigs. The proportion of animals surviving to full skeletal maturity suggests that both cattle and caprines were reared for a mix of meat and secondary products. In caprines, the priority

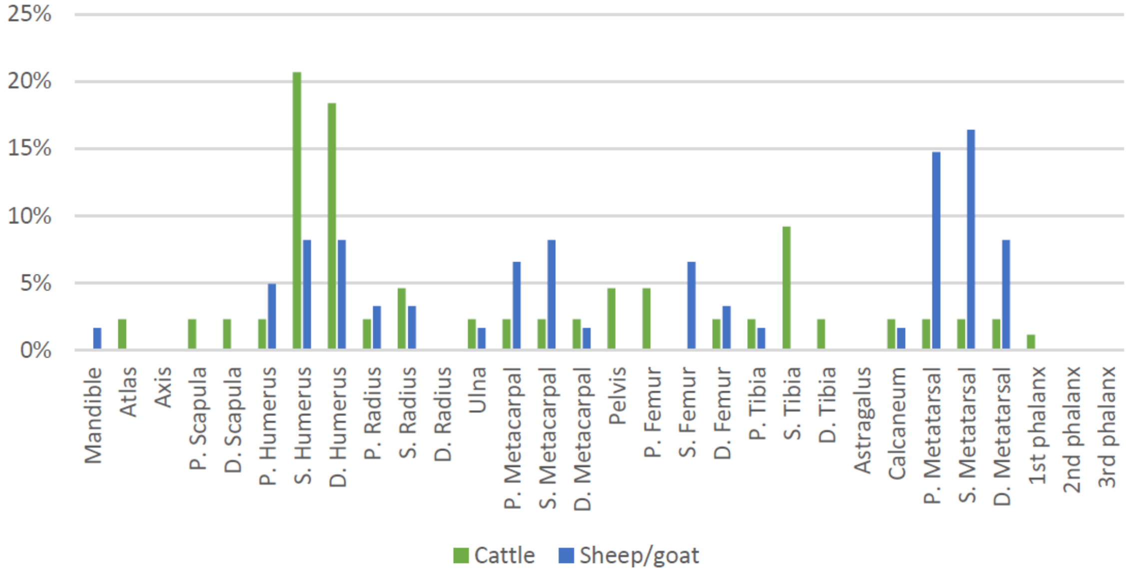


FIGURE 4.35: Phase 9 skeletal part abundances for cattle and caprines by MAU from Good Shepherd Hospital

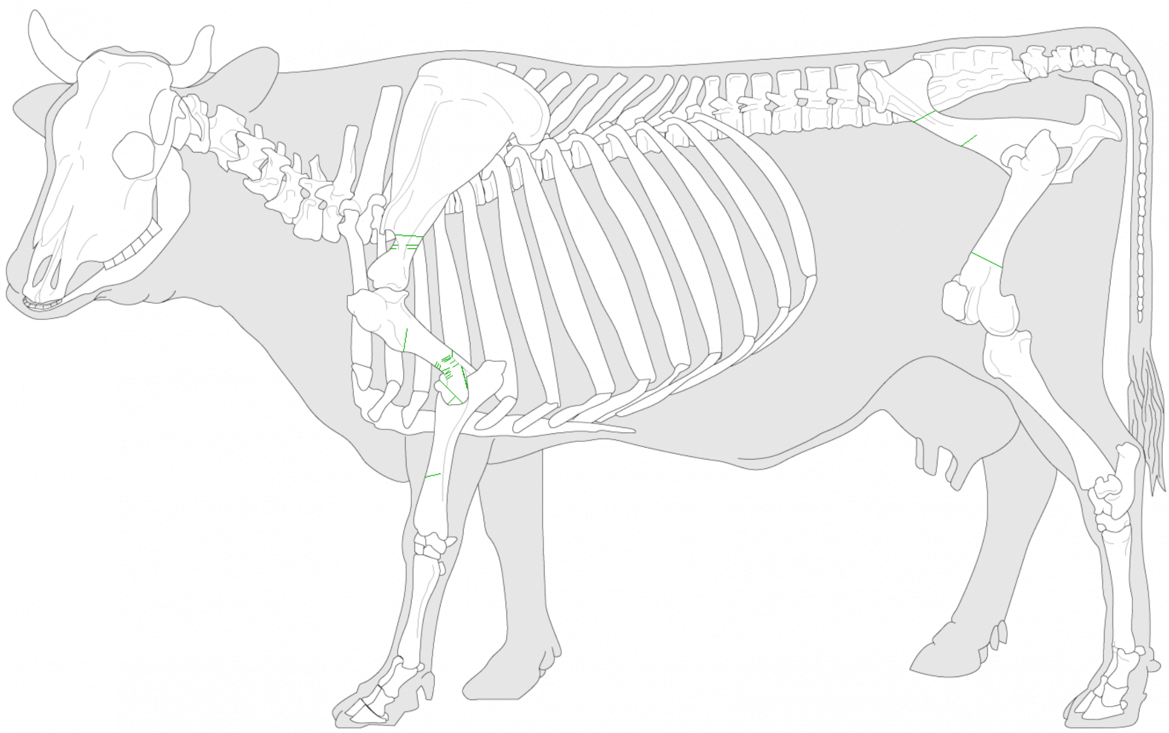


FIGURE 4.36: Cattle butchery from phase 9 at Good Shepherd Hospital. Key: green – chop

TABLE 4.50: Summary of cattle and caprine measurements from Good Shepherd Hospital, with number of specimens, average, minimum and maximum measurements

Phase 9		Cattle				Caprines			
Element	Measurement	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.
Astragalus	GLl								
Femur	Bd					*1*	36,1	36,1	36,1
	Bp								
	GL								
	SD								
Horncore	Greatest (o-a)								
	Least (d-b)								
Humerus	Bd	*5*	78,82	69,2	89,1	*5*	28,68	27,3	31,6
	Bp								
	GL								
	SD								
Metacarpal	Bd	*1*	54,6	54,6	54,6	*1*	25,4		
	Dd	*1*	29,6	29,6	29,6	*1*	16,4		
	Bp	*1*	52,2	52,2	52,2	*1*	21,87	20,6	22,8
	GL	*1*	183	183	183	*1*	119,1		
	SD	*1*	29,4	29,4	29,4	*1*	14,5		
Metatarsal	Bd					*4*	23,13	22,4	24,3
	Dd					*4*	14,75	14	16,1
	Bp					*9*	19,88	17,9	22
	GL					*3*	122,5	114,4	138,6
	SD					*3*	11,77	11,7	11,8
M3	Length								
Radius	Bd								
	Bp					*2*	28,77	26,7	30,3
	GL								
	SD								
Scapula	GLP	*1*	61,3	61,3	61,3				
Tibia	Bd	*1*	59,9	59,9	59,9				
	Bp								
	GL								
	SD								

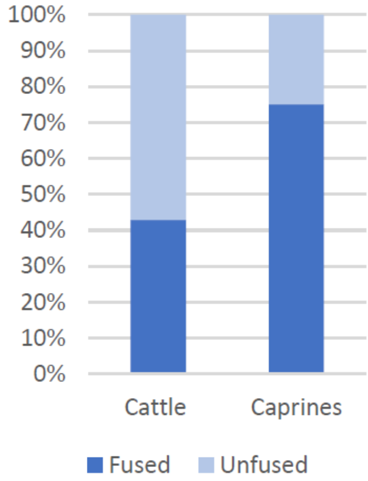


FIGURE 4.37: Stage 4 fusion in cattle and caprines from phase 9 at Good Shepherd Hospital

was more likely to be secondary products as more animals survived past stage 4. Dental wear could only be recorded on a single caprine mandible (wear stage F).

Sex: No specimens were suitable for recording of sex.

Metrics: Summaries of the measurements from cattle and caprines are presented in Table 4.50. No pig specimens were suitable for measurements.

4.8 Haven Banks (HB)

RAMM accession number: 328/2006

Exeter archive site 93

Excavation year: 1988

Extramural

4.8.1 Site description

The small excavation at Haven Banks, along with several other excavations, on the riverside of the Exe identified a large artificial channel made to divert water away from the river so as to facilitate the construction of the deep-water channel and wharf in 1698-1701.

TABLE 4.51: Fragment counts by phase from Haven Banks

Phase	NISP	Fish	Unidentifiable
10	147	-	272

TABLE 4.52: Fragment counts of speciesby phase from Haven Banks

Species	10
Cattle	52
Sheep/goat	73
Pig	1
Sheep	7
Dog	1
Horse	1
Medium mammal	6
Large mammal	4
Domestic fowl	1
Goose	1

4.8.2 The faunal remains

The Haven Banks faunal assemblage consists of 419 specimens all dated to phase 10. 147 of these are identifiable and the remaining 272 could not be identified to species level (Table 4.51). Almost all specimens are either cattle or caprine with the MAU division being 31% cattle and 69% caprine (Table 4.52, Table 4.53). Seven of the caprine metapodia are metrically identifiable as sheep and none are goat suggesting that the majority of the caprines are sheep rather than goats. Just under 25% of the identifiable specimens have fresh fractures on them, but as indicated by the FFI score of nearly 4, the vast majority of the specimens were fractured when they were dry or mineralized (Table 4.54, Figure 4.38). As there are only two cases of burning, heat is unlikely to have influenced the high FFI score. The relatively low weathering score combined with the lack of carnivore gnawing suggests that the fresh fractures are made by humans despite the lack of impact scars (Table 4.55).

Skeletal part abundance: There appears to have been a slight recovery bias against the late fusing and small elements such as astragali, distal radii, and distal femora, particularly from caprines (Figure 4.39). Except for heads and scapulae, the whole body is present from cattle. The majority of the parts are present in fairly equal amounts, apart from shaft and proximal femora which are two and three times as frequent as any other part

TABLE 4.53: MAU absolute counts and relative frequencies of major domesticates by phase from Haven Banks

Species	10	%
Cattle	26	31%
Sheep/goat	57.75	69%
Pig	0	0%

TABLE 4.54: Fragmentation counts and FFI score from Haven Banks

Fracture	Amount
Fresh	21
Fresh + dry	2
Fresh + dry + mineralised	0
Fresh + mineralised	1
Dry	34
Dry + mineralised	3
Mineralised	38
Impact scar	0
FFI score	3.95
New break	31
New break/NISP ratio	1:5

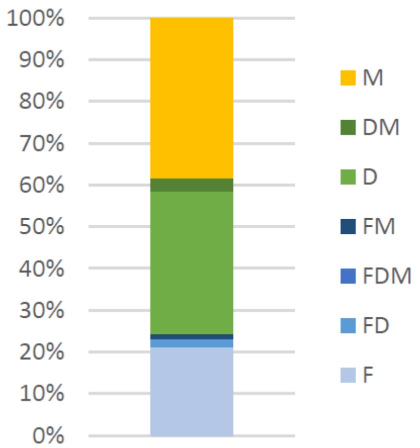


FIGURE 4.38: Phase 10 fracture history profile from Haven Banks

TABLE 4.55: Phase 10 taphonomy absolute counts and relative frequencies from Haven Banks

Type	Amount
Burning – singed	2
Burning	1.4%
Weathering score average	1.9

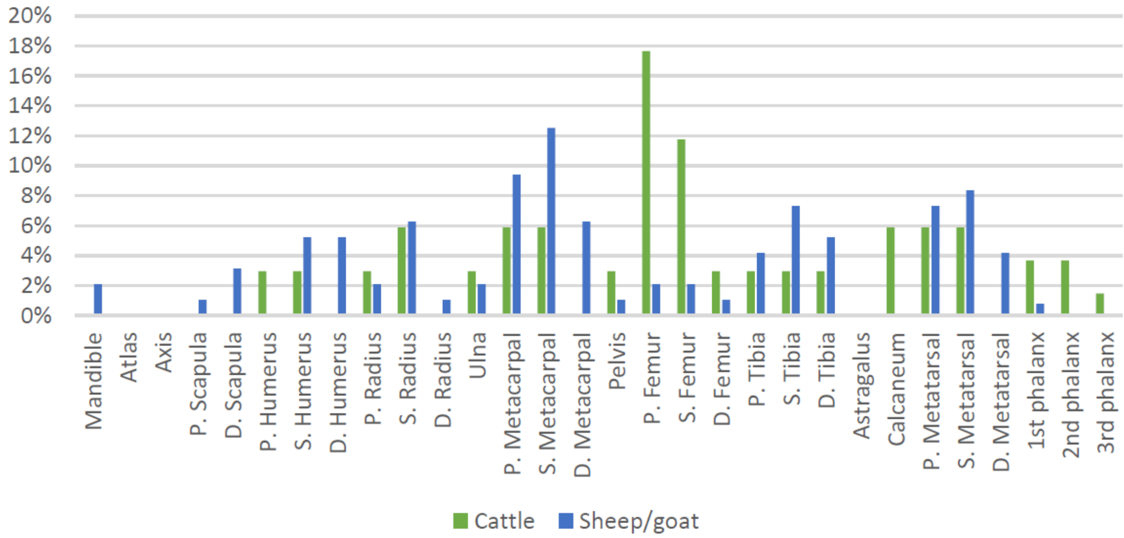


FIGURE 4.39: Phase 10 cattle and caprine skeletal abundances by MAU from Haven Banks

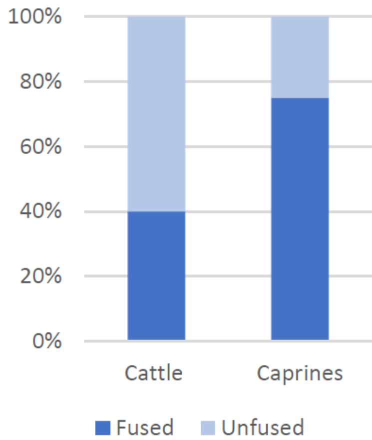


FIGURE 4.40: Stage 4 fusion in cattle and caprines from phase 10 at Haven Banks

TABLE 4.56: Summary of caprine measurements from Haven Banks, with number of specimens, average, minimum and maximum measurements

Caprine		Phase 10			
Element	Measurement	*n*	Average	Min.	Max.
Humerus	Bd	2	32,35	32	32,7
	Bp				
	GL				
	SD				
Metacarpal	Bd	3	27,83	25,6	29,6
	Dd	2	17,7	16,6	18,8
	Bp	3	24,65	22,8	26,5
	GL				
	SD				
Metatarsal	Bd				
	Dd				
	Bp	5	21,44	19,8	22,5
	GL				
	SD				
M3	Length				
Radius	Bd				
	Bp	1	33,7	33,7	33,7
	GL				
	SD				
Scapula	GLP				
Tibia	Bd	4	26,53	24,4	30,9
	Bp				
	GL				
	SD				

indicating a human selection for these meat-bearing bones. Similar to cattle, the whole body is represented for caprines. Metapodia are the most frequent followed by humeri, radii, and tibiae whereas femora only occur in low amounts. The low numbers of femora do not appear to be related to fracturing these bones for marrow as the majority of fresh fractures on caprine elements occur on metapodia. This suggests that the metapodia were preferred for marrow extraction, or rather, that they were used for tool making which is supported by the higher frequencies.

Butchery: 12 cases of butchery was recorded at Haven Banks. These are located on cattle, caprine, and large and medium mammal remains, with eight of those being on cattle remains. The number and locations of the butchery marks is too varied to draw any interpretations from.

Aging - fusion and dental wear: The relative proportions of stage 4 fused and unfused elements in cattle and caprines are shown in Figure 4.40. No data are available for pigs. The proportion of animals surviving to full skeletal maturity suggests that both cattle and caprines were reared for a mix of meat and secondary products. For caprines, the priority was more likely to be secondary products as more animals survive past stage 4. No specimens were suitable for recording of tooth wear.

Sex: No specimens were suitable for recording of sex.

Metrics: Summaries of the measurements from caprines are presented in Table 4.56. No cattle or pig specimens were suitable for measurements.

4.9 Mermaid Yard (MY)

RAMM accession number: 47/2005

Exeter archive site 63

Excavation year: 1977-78

South Quarter

4.9.1 Site description

The Mermaid Yard excavations took place over two seasons in 1977 and 1978 in advance of new housing (Bedford and Salvatore n.d. a; Advisory Committee Report 1977; Advisory Committee Report 1978). The open area excavation was situated in the southernmost corner of the walled city within the foundations of a Victorian building which had a number of small cellars and substantial foundations. Along with the pits dug by a medieval bell-making foundry, these features had removed much of the underlying stratification. Despite the damage, archaeological evidence dating from the start of the Roman military period until the end of post-medieval period was recovered. The excavations straddled the defences of the Roman legionary fortress and the inner ditch and part of the rampart was located. The outer ditch was partly overlain by the *via sagularis* and the area south-east of the road had two phases of timber buildings dated to the late 3^{rd} or 4^{th} century which were succeeded by a masonry building. The Roman levels were sealed beneath a layer of dark loam containing medieval and residual Roman pottery.

TABLE 4.57: Fragment counts by phase from Mermaid Yard

Phase	NISP	Fish	Unidentifiable
1	75	-	420
2	1031	-	2486
3	28	-	22
6	14	-	43
7	215	2	563
8	26	-	55
9	100	3	173
10	7	-	17
R	89	1	211
M	47	1	114
PM	15	-	22
Undated	219	-	420

Only three pits could be associated with the Saxo-Norman period. The medieval evidence includes the pits and dumps of bell-mound fragments from the bell foundry as well as medieval tenements and a road that went out of use in the 13^{th} century. This was followed by 17^{th} century tenements (Bedford and Salvatore n.d. a; Advisory Committee Report 1977; Advisory Committee Report 1978).

4.9.2 The faunal remains

Out of the 6405 faunal remains, 7 were fish, 1866 were identifiable specimens and the remaining 4532 could not be identified to species level (Table 4.57). 55% of the identifiable material is infill of the Roman military ditch (phase 2), while several phases only have very little material. This is apparent in Figure 4.9.1 where no trends are visible for any of the periods and furthermore, the relative abundances for phase 2 and 9 – the phases with the largest NISPs – are visibly different to all the other phases. The small amounts of material mean that phase 3, 6, 8, M, 10 and PM will not be included in the further results presented below. What is clear from Figure 4.41 is that cattle and caprines are the two most abundant species at all times. They are followed by pig in phases 1 to 6, but after that only make up a small proportion of the total NISP. The amounts for the remaining species stay relatively stable over time, though all, apart from birds, appear to have slight increases in numbers particularly after phase 7 and until phase 10. Horse has a spike in numbers in phase 10, but this unlikely to be a genuine trend, as only 7

TABLE 4.58: Fragment counts of speciesby phase from Mermaid Yard

Species	1	2	3	6	7	8	9	10	R	M	PM
Cattle	20	542	12	3	114	13	33	2	30	18	7
Sheep/goat	25	212	9	7	46	6	33	4	18	15	5
Pig	12	142	5	3	11	1	-	-	21	3	2
Sheep	1	6	-	-	1	-	1	-	1	2	-
Goat	-	5	-	-	-	-	-	-	2	1	-
Cat	-	-	-	-	1	-	1	-	-	1	-
Dog	-	9	-	-	-	-	2	-	1	2	-
Roe deer	-	-	-	-	-	-	-	-	-	1	-
Fallow deer	-	-	-	-	1	-	1	-	-	-	-
Red deer	1	4	-	-	1	-	-	-	-	-	-
Rabbit	-	-	-	-	-	-	3	-	-	-	-
Horse	1	10	1	-	1	2	4	1	-	-	-
Badger	-	1	-	-	-	-	-	-	-	-	-
Medium mammal	4	45	-	-	11	1	12	-	6	-	-
Large mammal	6	18	-	-	26	2	6	-	3	2	-
Domestic fowl	4	27	1	1	1	-	2	-	7	2	1
Goose	-	1	-	-	-	1	2	-	-	-	-
Goose cf.	-	-	-	-	1	-	-	-	-	-	-
Mallard cf.	-	2	-	-	-	-	-	-	-	-	-
Duck sp.	-	1	-	-	-	-	-	-	-	-	-
Woodcock	1	4	-	-	-	-	-	-	-	-	-
Eider	-	1	-	-	-	-	-	-	-	-	-
Teal	-	1	-	-	-	-	-	-	-	-	-

identifiable specimens were recovered from this phase and only one of these is horse (Table 4.57 and Table 4.58).

MAU: in terms of MAU for cattle, caprines and pigs, caprines are the most frequent in phase 1 and 9 with a 43% increase in the relative abundance between phase 7 and 9 (Table 4.59 and Figure 4.42). Cattle dominate in phase 2, R and 7 by representing between 44% and 67% of all specimens from the three species. Similar to at other sites, pigs are at their most abundant in the Roman phases.

TABLE 4.59: MAU absolute counts and relative frequencies of major domesticates by phase from Mermaid Yard

	1	2	7	9	R
Cattle	12.25	238.5	74.75	13	19
Sheep/goat	20	150.25	28.25	28	15
Pig	3	71.25	8	0	8.75
Cattle %	35	52	67	32	44
Sheep/goat %	57	33	25	68	35
Pig %	9	15	7	0	20

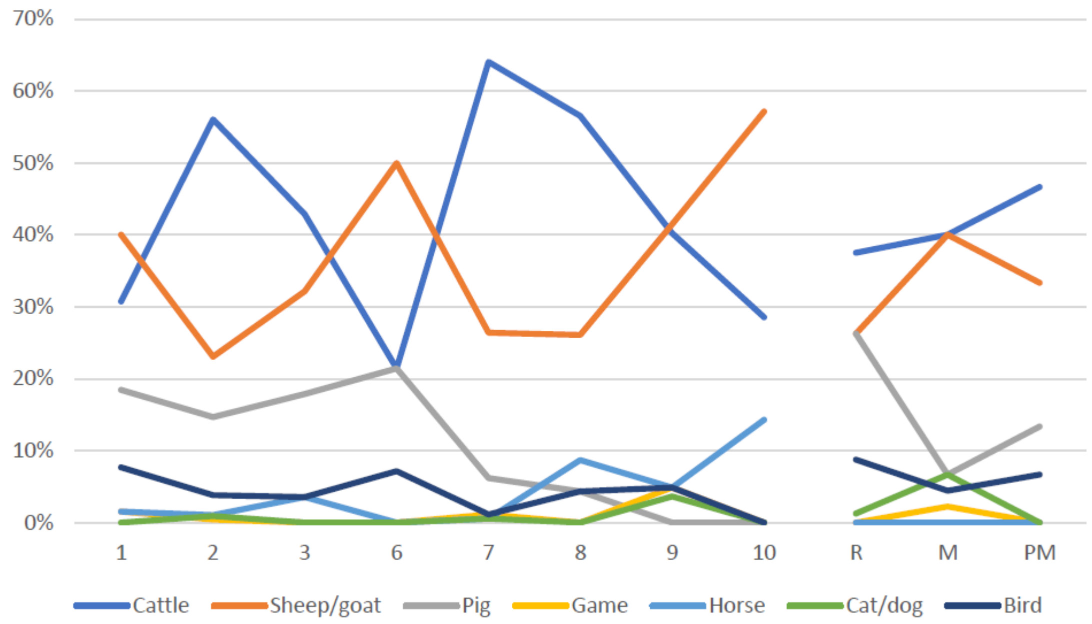


FIGURE 4.41: Frequencies by NISP of species and groups by phase from Mermaid Yard

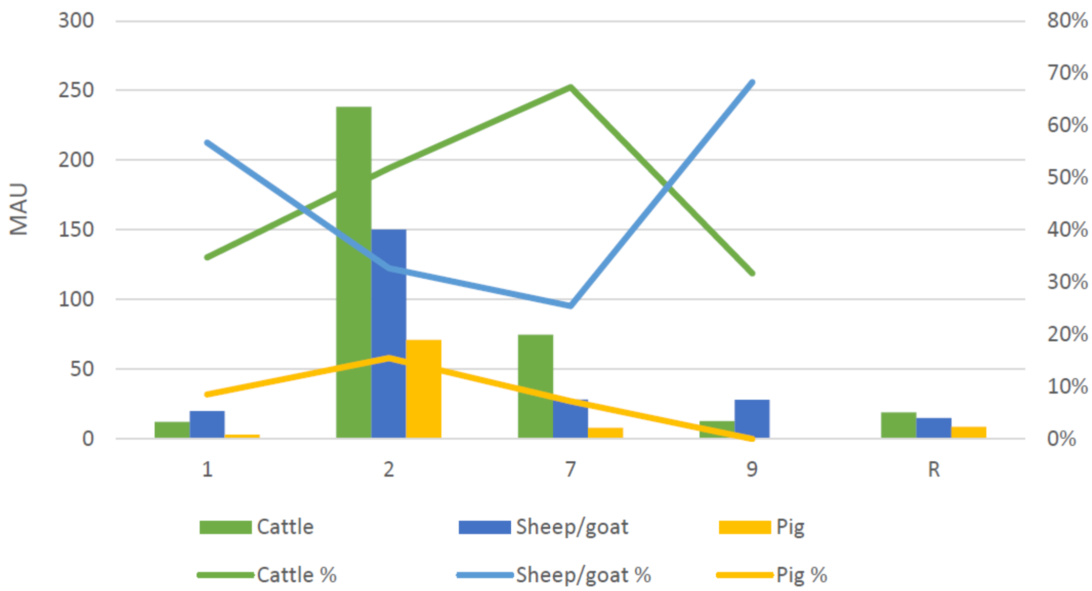


FIGURE 4.42: MAU absolute counts (primary axis) and relative frequencies (secondary axis) of major domesticates by phase from Mermaid Yard

TABLE 4.60: Fragmentation counts and FFI scores by phase from Mermaid Yard

Fracture	1	2	7	9	R
Fresh	5	189	30	12	9
Fresh + dry	0	3	1	0	0
Fresh + dry + mineralised	0	0	1	0	0
Fresh + mineralised	0	12	2	2	0
Dry	13	79	19	5	3
Dry + mineralised	0	8	3	0	0
Mineralised	9	245	40	19	25
Impact scar	0	4	0	1	0
FFI score	3.5	3.8	3.9	4.1	4.6
New break	3	218	88	17	21
New break/NISP ratio	1:25	1:5	1:2	1:6	1:4

Fragmentation: The fragmentation patterns for phase 2, 7 and 9 are very similar with approximately 35% of all identifiable specimens exhibiting fresh fractures, 15-20% have dry fractures, and 40-50% have mineralised fractures (Figure 4.43). The FFI scores also reflect the similarities between some phases, with phase R having the highest score at 4.6 and phase 1 the lowest score (Table 4.60). Despite the relatively lower score for phase 1, it also has the highest frequency of dry fractures along with the lowest frequency of fresh and mineralised fractures. In comparison, phase R has a higher percentage of fresh fractures and the lowest of dry fractures. What brings the FFI score up for this phase is the high frequency of mineralised fractures. The fracture patterns suggest that in Mermaid Yard contexts, bones were treated similarly in phase 2, 7 and 9 in terms of how many were fractured while fresh as well as the post-consumption and deposition processes that affect the contexts. The contexts that produced phase 1 material seem more likely to represent activities that handle the bones after the meat has been consumed though there are no butchery or tool marks to suggest that the bones were worked. On the other hand, the high frequency of mineralised fractures in the phase R seems more indicative of post-depositional damage.

Taphonomy: the average weathering score increases with the age of the bones (Table 4.61). Phase 9 has the lowest average, meaning that the bones have the least surface erosion, and phase 1 has the highest average. The only phase that does not follow this pattern is phase 2, but this is likely due to the nature of the deposition. As mentioned previously,

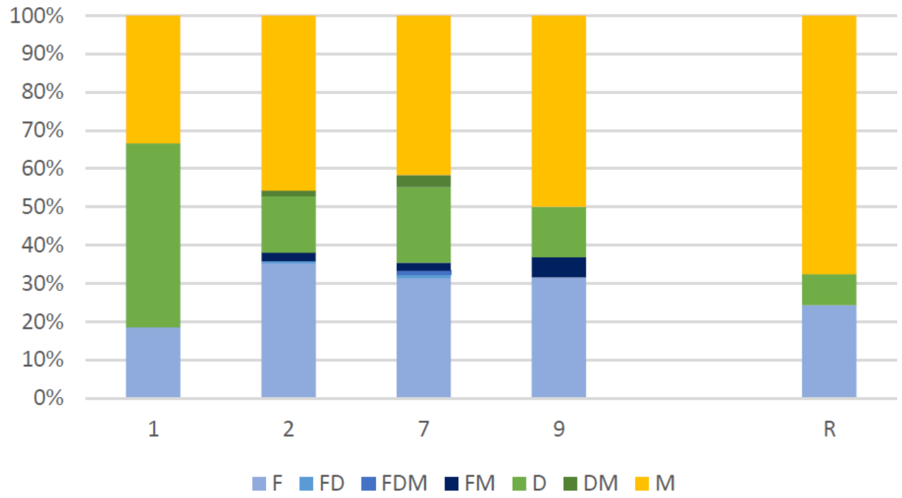


FIGURE 4.43: Fracture history profile by phase from Mermaid Yard

TABLE 4.61: Taphonomy absolute counts and frequencies by phase from Mermaid Yard

Type	**1**	**2**	**7**	**9**	**R**
Carnivore gnawing	1	88	17	8	10
Root etching	-	2	-	-	-
Staining	1	2	8	72	-
Burning – singed	9	32	22	14	7
Burning – charred	-	1	1	2	-
Carnivore gnawing	1.3%	8.5%	7.9%	8%	11.2%
Burning - all	12%	3.2%	10.7%	16%	7.9%
Weathering score average	2.6	1.4	1.25	1.2	1.7

the phase 2 material is primarily infill of the defensive ditch which may have resulted in wetter conditions that in the surrounding features and thereby better bone preservation. When looking at the recorded gnawing, the proportion varies between 8% and 11% in the four latter phases, only phase 1 stands out as having a single specimen with carnivore gnawing out of the 75 identifiable specimens. While the trends could not be recorded for the remaining medieval and post-medieval phases, the ones presented below at least suggest that carnivores, after the end of the military occupation, had equal access to discarded bones. On the other hand, there are no clear similarities between phases in terms of exposure to heat, it appears to vary between contexts and has no apparent relation to specific phases. For example, in phase 2, approximately 3% of the total NISP has signs of heat damage, whereas in phase 9 it is 16% and the other phases lie in between. Unusually, the Mermaid Yard faunal material, particularly in the later phases, has a high proportion of stained specimens. This was caused by post-1800 industrial activities in the vicinity of the site that has stained the bones in colours ranging from turquoise to emerald green.
Skeletal part abundance: similar to all other Exeter sites, at Mermaid Yard there was a recovery bias against small elements and late fusing epiphyses (Figure 4.44, 4.45, and 4.46). This is visible as the absence or comparatively low numbers of, for example, phalanges, tarsals, proximal humeri, and distal metapodia, particularly from caprines. In general, the majority of the skeleton or the whole body is represented for cattle and caprines, however, the dataset for pigs is too small to draw any broad conclusions. As mentioned above, between 8% and 11% of all specimens in the four latter phases display signs of carnivore gnawing. As carnivores target the spongy ends of long bones these may be underrepresented in affected phases. Only a few atlases and axes have been identified which is likely due to the difficulty of identifying them to a species when they are fractured.

In four of the five phases, metapodia are among the most frequently occurring elements for cattle (Figure 4.44). In phase 1, metatarsals in particular are twice or three times as frequent as any other elements. This trend is even more pronounced in phase two, though mandibles and scapulae have similar frequencies to metacarpals. The general Roman phase has a slightly different pattern to phase 1 and 2. Metapodia are still

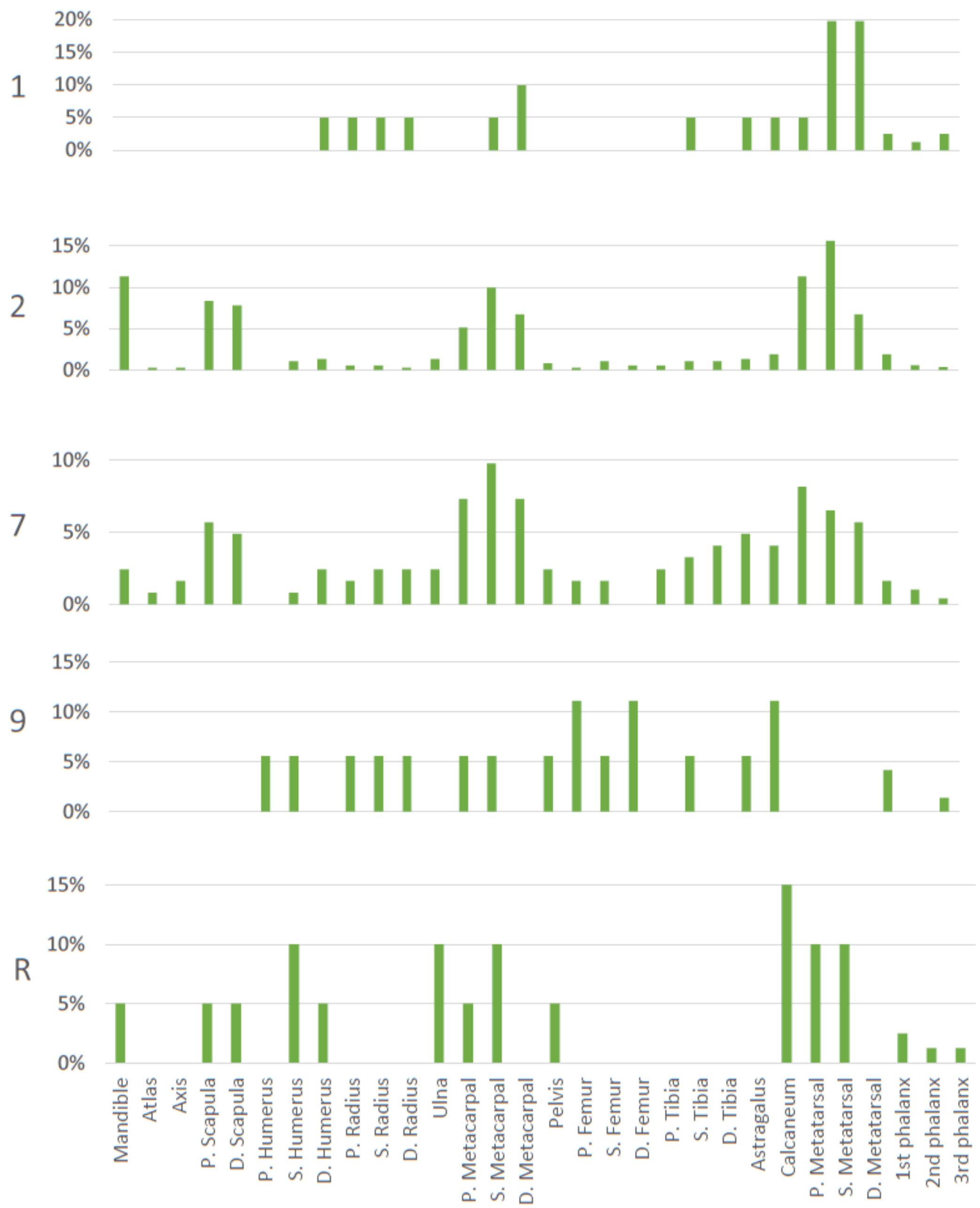


FIGURE 4.44: Cattle skeletal part abundances by MAU by phase from Mermaid Yard

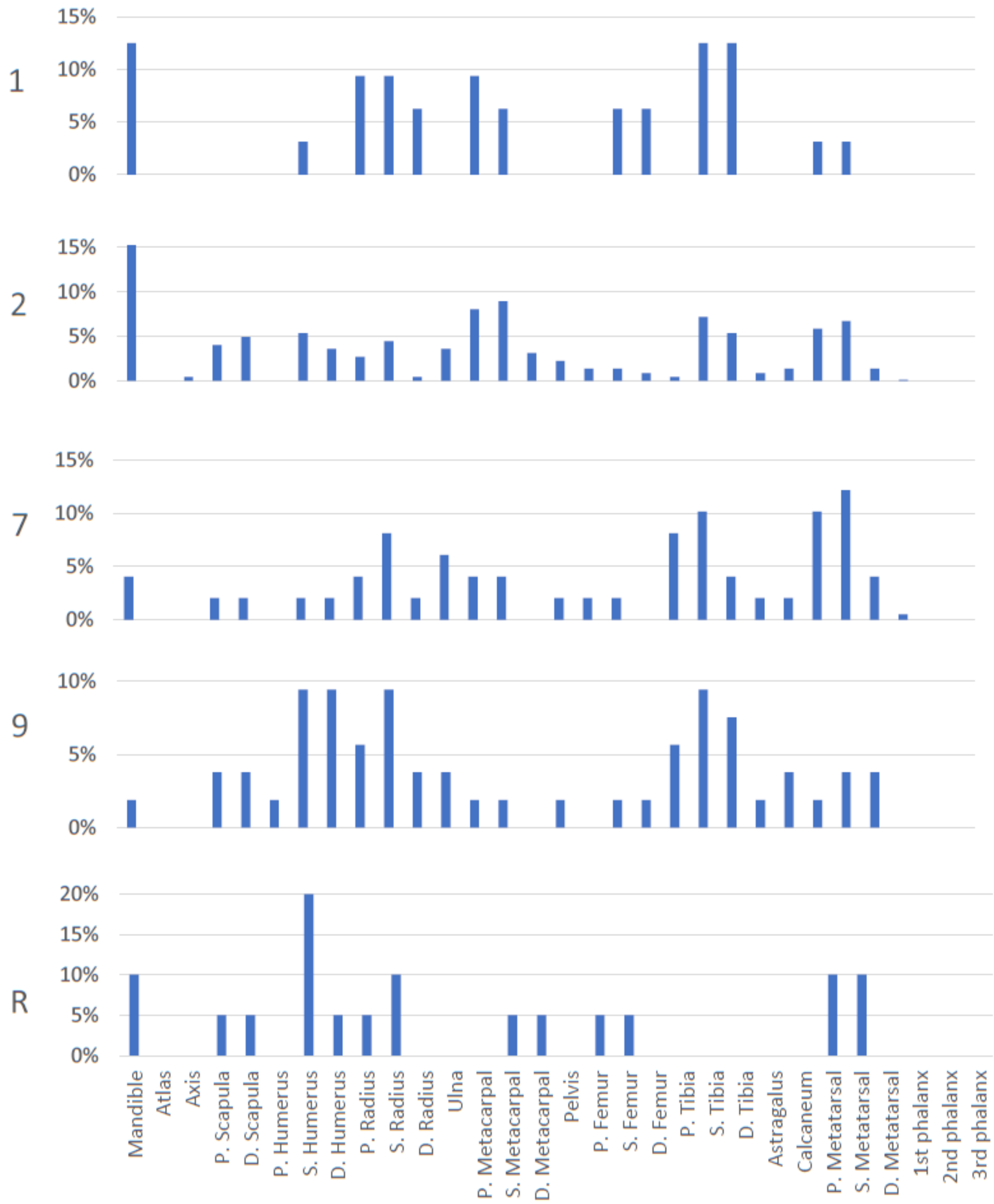


FIGURE 4.45: Caprine skeletal part abundances by MAU by phase from Mermaid Yard

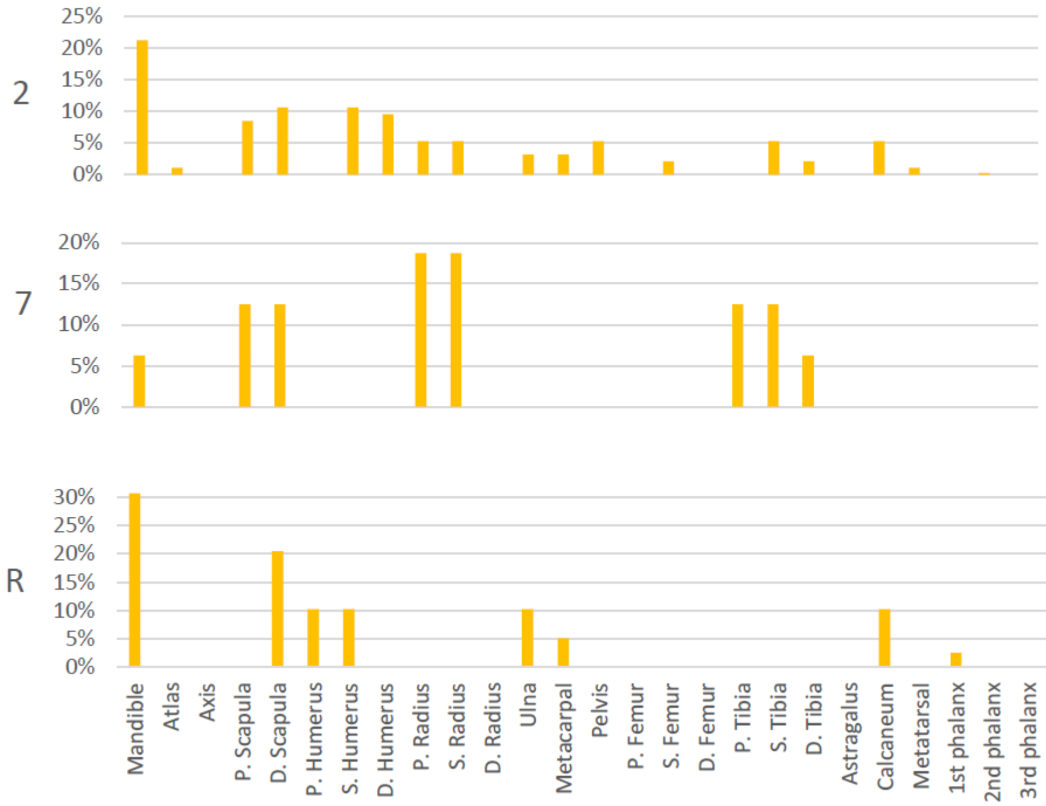


FIGURE 4.46: Pig skeletal part abundances by MAU by phase from Mermaid Yard

very frequent alongside ulnae and humeri while calcanei are the most frequent. By phase 7, metapodia dominate once again, though all other elements have a much higher presence in the assemblage. The assemblage composition in phase 9 has little similarity to any of the previous phases. Femurs and calcanei are now the most frequent with the other represented elements present in almost equal numbers. These shifts in trends over time, and lack thereof, indicate that the Mermaid Yard site contained what is likely to be large amounts of butchery waste combined with some household waste in the form of small relatively amounts of meat bearing bones. It is not until the medieval period (phase 7) that the household waste becomes a more abundant part of the assemblage. By the early post-medieval period (phase 9) the trend has shifted completely, and meat bearing bones now dominate the assemblage, and the low utility bones only make up a small part.

The skeletal part abundance for caprines are visibly different to those of cattle as metapodia are no longer the dominant elements apart from in phase 7 (Figure 4.45). In the Roman military period (phase 1) mandibles and tibiae are the most frequent elements followed by radii, metacarpals and femurs. Phase 2 has a fairly even representation across the body, though with mandibles representing 15% of all skeletal parts. There are also slight peaks for metapodia and tibiae, though not enough to indicate a consistent selection for these elements. Once again, the general Roman phase does not reflect the same patterns as phase 1 and 2 suggesting that the material represents different activities than the context that can be dated to phase 1 and 2. As mentioned above, metatarsals are the most frequent element in phase 7 closely followed by tibiae, though the majority of the skeleton is present in smaller amounts. Similar to cattle, the patterns for the post-medieval period differ visibly from the previous phases. While the majority of the skeleton is still present, the meat bearing bones clearly dominate suggesting a conscious selection for these elements.

The MAUs for pigs are considerably lower than those of cattle and caprines, so the skeletal parts abundances for phase 1 and 9 could not be included here. The MAUs for phase R and 7 are respectively 8.75 and 8 so it should be noted that the patterns presented in Figure 4.46 may not be fully representative of the whole phases. In phase 2 the whole skeleton is present, though mandibles are by far the most frequent with scapulae and

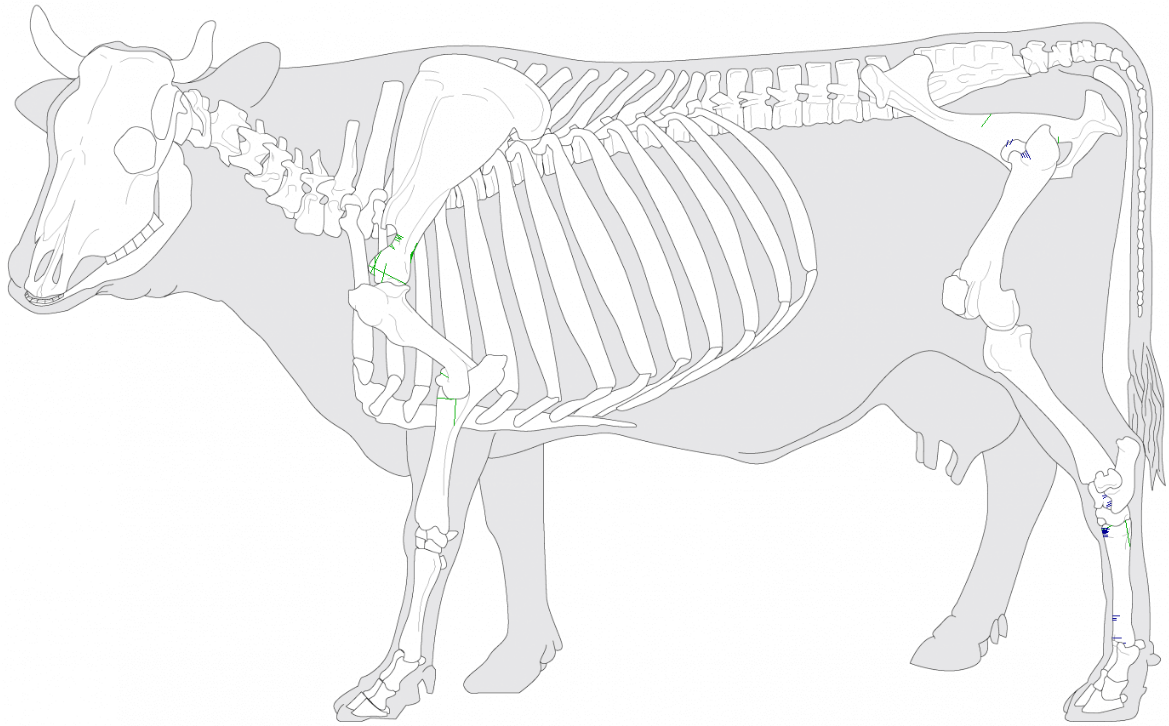


FIGURE 4.47: Cattle butchery from phase 2 at Mermaid Yard. Key: green - chop

humeri following. The same trend is apparent in the general Roman phase, though, only a few elements are present. By phase 7, radii are now the most abundant followed by scapulae and tibia suggesting a preference for the meat bearing elements.

Butchery: Few cases of butchery were recorded on specimens from 1, R, 7 and 9, so they will not be included in this section. However, 54 out of the 1031 identifiable specimens from phase 2 have butchery marks on them so these will be presented here. 36 of the 54 cases were found on cattle remains (Figure 4.47 and 4.48), with the remaining divided between caprines (five), red deer (three), horse (two), large mammal (one), medium mammal (two), and pig (five). The recorded cases of butchery on cattle remains are primarily chop marks located on or around the glenoid fossa and spine of the scapula. The location of these marks is consistent with trimming the scapula in preparation for smoking or brining.

Aging - fusion: The relative proportions of stage 4 fused and unfused elements in cattle, caprines, and pigs show clear differences in the slaughter ages. Stage 4 is the final fusion stage, so the data presented in Figure 4.49, 4.50, and 4.51 shows the proportion of animals

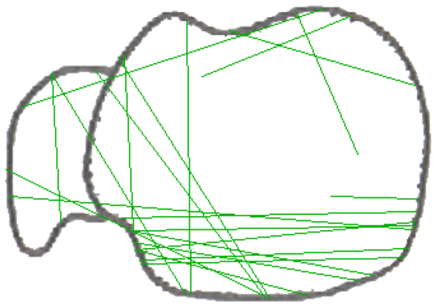


FIGURE 4.48: Butchery on proximal cattle scapula from phase 2 at Mermaid Yard. Key: green - chop

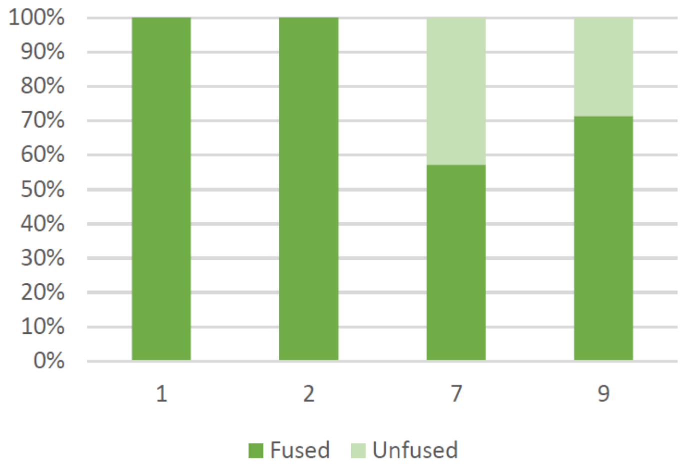


FIGURE 4.49: Stage 4 cattle fusion by phase from Mermaid Yard

that had fully fused skeletons against the ones that died before this stage. Phase R has not been included here due to too little data. For the phases where data are available, all pigs are killed before they reach stage 4 suggesting that they were all reared for meat (Figure 4.51). In the two Roman phases all cattle lived past skeletal maturity indicating that they were kept for secondary products, most likely traction (Figure 4.9.49). In phase 7 and 9, secondary products were still the priority, but some may have been reared for meat. The same is visible for caprines in phase 1 and 9, though in phase 2 and 7, meat is likely to have been the main priority (Figure 4.50).

Aging - dental wear: Table 4.62, 4.63, and 4.64 present absolute counts for the number of mandibles of cattle, caprines, and pigs at each wear stage. Pigs and phase 1, 7 and 9 do not have enough data to be presented further here. In phase 2, almost all cattle and caprines range between wear stage D and G indicating that most cattle got killed between 18-30 months and 'old adult', and caprines between 1-2 and 4-6 years. The caprine tooth

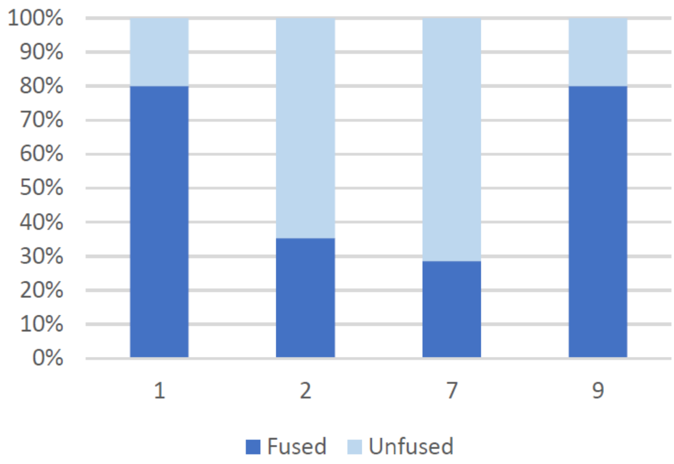


FIGURE 4.50: Stage 4 caprine fusion by phase from Mermaid Yard

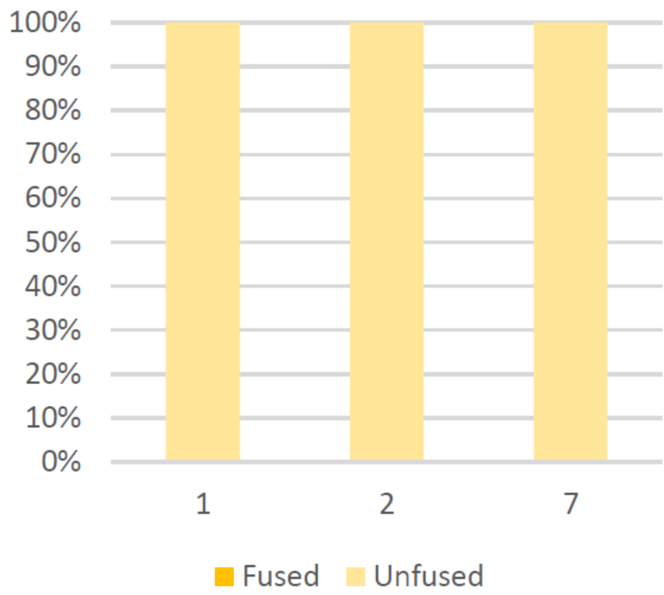


FIGURE 4.51: Stage 4 pig fusion by phase from Mermaid Yard

TABLE 4.62: Cattle tooth wear by phase from Mermaid Yard

Wear stage	1	2	7	9	R
A	-	-	-	-	-
B	-	-	-	-	-
C	-	-	-	-	-
D	-	3	-	-	-
E	-	1	-	-	-
F	-	3	-	-	-
G	-	6	-	-	-
H	-	1	-	-	-
I	-	-	-	-	-

TABLE 4.63: Caprine tooth wear by phase from Mermaid Yard

Wear stage	1	2	7	9	R
A	-	-	-	-	-
B	-	-	-	-	-
C	-	1	-	-	-
D	1	2	-	-	-
E	1	6	-	-	-
F	-	1	-	-	2
G	-	3	-	-	-
H	-	-	1	-	-
I	-	-	-	-	-

TABLE 4.64: Cattle tooth wear by phase from Mermaid Yard

Wear stage	1	2	7	9	R
A1	-	-	-	-	-
A2	-	-	-	-	-
A3	-	-	-	-	-
B	-	3	-	-	-
C	-	-	1	-	-
D	-	-	-	-	-
E	-	1	-	-	-
F	-	-	-	-	-
G	-	-	-	-	-

wear stages correlate with the fusion data, though the cattle data do not, suggesting that more data or further analysis is needed to get a clear picture of how cattle was kept.

Sex: Table 4.65 presents the absolute counts for identified male and female cattle, caprines, and pigs. There are too few data available to be presented further here.

Metrics: Summaries of the measurements from cattle, caprines and pigs are presented in Table 4.66 and 4.67. Phases with fewer than five measurements from a species have not been included here.

TABLE 4.65: Absolute counts of sex for major domesticates by phase from Mermaid Yard

		1	2	7	9	R
Cattle	Male	-	-	-	-	-
	Female	-	-	-	-	-
Caprines	Male	-	-	-	-	-
	Female	-	-	-	-	-
Pig	Male	-	4	-	-	-
	Female	1	2	-	-	-

TABLE 4.66: Summary of caprine measurements from Mermaid Yard, with number of specimens, average, minimum and maximum measurements

Caprines		Phase 1				Phase 2				Phase 7				Phase 9			
Element	Measurement	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.
Astragalus	GL1									*1*	24,86	24,86	24,86	*1*	27,6	27,6	27,6
Femur	Bd	*1*	32,37	32,37	32,37									*1*	37,5	37,5	37,5
	Bp																
	GL																
	SD																
Horncore	Greatest (o-a)	*0*															
	Least (d-b)	*0*															
Humerus	Bd					*3*	26,38	23,2	28,62					*4*	29,14	28,47	29,5
	Bp																
	GL																
	SD																
Metacarpal	Bd					*7*	23,04	20,7	27,3								
	Dd					*5*	16,26	14,3	21,8								
	Bp	*2*	18,98	18,97	18,98	*11*	20,81	18,6	24,8					*1*	20,35	20,35	20,35
	GL					*3*	113,77	101,6	130,2								
	SD					*3*	15,17	12,3	17,5								
Metatarsal	Bd	*1*	20,69	20,69	20,69	*2*	20,89	20,78	20,99	*2*	20,66	19,75	21,56	*2*		22,92	23,18
	Dd	*1*	13,74	13,74	13,74	*2*	14,01	13,27	14,74	*1*	14,73	14,73	14,73	*2*		14,56	15,27
	Bp	*1*	18,61	18,61	18,61	*8*	17,81	16,55	18,5	*4*	18,66	17,72	19,54	*1*	19,57	19,57	19,57
	GL	*1*	123,16	123,16	123,16	*1*	120,84	120,84	120,84	*2*	120,89	118,84	122,94	*1*	121,89	121,89	121,89
	SD	*1*	9,49	9,49	9,49	*1*	9,33	9,33	9,33	*2*	10,82	10,2	11,43	*1*	11,46	11,46	11,46
M3	Length																
Radius	Bd	*1*	29,7	29,7	29,7	*2*	25,19	22,87	27,5					*2*	27,01	26,24	27,77
	Bp	*2*	28,73	25,22	32,23	*4*	26,28	17,9	31,53	*1*	30,25	30,25	30,25	*2*	30,19	29,59	30,79
	GL	*1*	151,14	151,14	151,14												
	SD	*1*	18,14	18,14	18,14												
Scapula	GLP					*1*	26,8	26,8	26,8					*1*	30,92	30,92	30,92
Tibia	Bd	*1*	22,46	22,46	22,46	*9*	23,47	21,6	25,4	*1*	23,83	23,83	23,83	*5*	26,24	24,31	29,02
	Bp					*1*	35,3	35,3	35,3					*2*	39,76	39,07	40,45
	GL																
	SD																

TABLE 4.67: Summary of cattle and pig measurements from Mermaid Yard, with number of specimens, average, minimum and maximum measurements

		Cattle - Phase 1				Cattle - Phase 2				Pig - Phase 2			
Element	Measurement	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.
Astragalus	GL1					*3*	54,58	53,5	55,65				
Femur	Bd												
	Bp												
	GL												
	SD												
Horncore	Greatest (o-a)					*5*	40,13	31,3	62,9				
	Least (d-b)					*5*	28,78	23,8	40,7				
Humerus	Bd					*1*	77,53	77,53	77,53	*3*	37,56	36,1	38,38
	Bp									*1*	36,88		
	GL												
	SD												
Metacarpal	Bd	*1*	51,11	51,11	51,11								
	Dd	*1*	29,19	29,19	29,19								
	Bp					*15*	48,99	41,06	56,9				
	GL												
	SD												
Metatarsal	Bd	*2*	46,72	45,05	48,39	*3*	44,4	43,3	45,8				
	Dd	*2*	27,13	27,12	27,13	*3*	26,57	25,9	27,5				
	Bp					*23*	40,94	38,27	45,31				
	GL					*1*	193	193	193				
	SD					*1*	21,4	21,4	21,4				
M3	Length												
Radius	Bd	*1*	61,89	61,89	61,89								
	Bp	*1*	72,71	72,71	72,71					*4*	27,92	27,29	28,3
	GL												
	SD												
Scapula	GLP					*3*	57,67	50,9	62				
Tibia	Bd					*3*	53,53	48,5	56,6	*1*	29,27	29,27	29,27
	Bp					*1*	87,5	87,5	87,5				
	GL					*1*	321	321	321				
	SD					*1*	35,4	35,4	35,4				

4.10 Paul Street (PS)

RAMM accession number: 6/2005

Exeter archive site 76

Excavation year: 1982-85

North Quarter

4.10.1 Site description

The Paul Street excavations were undertaken between 1982 and 1985 by the Exeter Museums Archaeological Field Unit in advance of the construction of the Harlequin shopping centre and multi-storey car park development (Bedford and Salvatore n.d. c; Advisory Committee Report 1984). The site comprises several open area excavations located between the military fortress defences and the Roman City Wall. Roman, medieval, and post-medieval remains were recorded, and some Iron Age finds were found as well including a La Tene decorated piece of pottery. The Roman military features include the fortress defences and a road running along the outside of the ditch. The later Roman features showed the sequence of construction for the City Wall and its associated defences. During the medieval period the area is likely to have had several tenements of 50 meters in length and approximately 11.5 meters wide, many of which existed in smaller forms into the post-medieval period. Very little material predates AD 1200, though series of pits suggest rather intensive settlement after this date. Little information is available on the post-medieval period, though some exceptional finds from the 16^{th} century have been described. These include imported ceramic and glassware from the Netherlands, Spain, Northern Europe, and Venice. The faunal analysis for this thesis also identified what may be the remains of one of the earliest turkeys imported from the New World to England in associated contexts (Advisory Committee Report 1984; Bedford and Salvatore n.d. c; Lauritsen *et al.* 2018).

4.10.2 The faunal remains

A total of 6565 specimens were recovered from the Paul Street excavations, 2304 were identifiable bird and mammal specimens, another 70 were fish, and the remaining 4191

TABLE 4.68: Fragment counts by phase from Paul Street

Phase	NISP	Fish	Unidentifiable
1	10	-	17
2	82	-	373
3	46	-	106
5	1	-	-
6	54	3	111
7	338	30	774
8	320	10	531
9	719	21	1051
10	155	3	241
R	81	2	220
M	309	-	496
PM	23	-	39
Undated	166	1	248

could not be identified to species level (Table 4.68). The majority of the material was recovered from features dating to between 1150 and 1800 with the largest amount being from phase 9 which includes the high-status contexts with the imported pottery and glassware mentioned above. In terms of NISP, cattle and caprines are the most abundant of all mammal species though pigs and domestic fowl also occur in considerable numbers and are therefore likely to have been a frequent part of the diet in most phases (Table 4.69). Game, on the other hand, is only an infrequent occurrence though it is present in all periods except the Saxo-Norman (Table 4.69, Figure 4.52). It should be noted that the data for phase 5 have not been included in Figure 4.52 as only a single identifiable specimen was recovered from this phase. Two further trends are apparent from Figure 4.52. While horse never makes up a major part of any phase, it is clear that it is much more common in the Roman phases than in any of the later periods. Furthermore, there is a unusual spike in relative frequencies of cat/dog specimens; however, this is due to a partial cat skeleton and therefor unlikely to be representative for the phase. In the further results presented below, phase 1, 3, 5, 6, and PM will not be included due to their low NISPs.

MAU: Out of the three species included in Table 4.70 and Figure 4.53, pig is the one with the steadiest frequency throughout these phases. Cattle and caprines vary a lot more. Cattle is at its most frequent in the two Roman phases but is nearly 30% less frequent by phase 7. The numbers then increase in phase 8 and M but decrease towards phase 10. Caprines, however, show the exact opposite pattern.

TABLE 4.69: Fragment counts of species by phase from Paul Street

Species	1	2	3	5	6	7	8	9	10	R	M	PM
Cattle	4	49	24	1	10	100	95	224	53	36	145	1
Sheep/goat	2	11	9	-	27	137	107	217	56	16	92	8
Pig	2	7	7	-	6	25	25	47	12	11	23	1
Sheep	-	1	-	-	-	1	7	4	2	1	4	-
Goat	-	1	-	-	-	2	1	-	-	-	5	-
Cat	-	-	-	-	1	3	12	9	2	-	-	9
Dog	-	1	1	-	-	9	8	7	3	-	1	-
Roe deer	-	-	-	-	-	-	-	1	1	-	-	-
Fallow deer	-	-	-	-	-	-	3	1	1	-	-	-
Red deer	-	-	1	-	-	-	-	-	-	2	-	1
Rabbit	-	-	-	-	-	1	-	8	-	-	-	-
Hare sp.	-	1	-	-	-	-	1	1	5	-	1	-
Horse	1	6	2	-	-	4	8	12	1	11	1	-
Badger	-	-	-	-	-	-	-	-	-	-	-	-
Common lobster	-	-	-	-	1	-	-	-	-	-	-	-
Hedgehog	-	-	-	-	-	-	-	1	-	-	-	-
Rat sp.	-	-	-	-	-	-	-	2	-	-	-	-
Small mammal	-	-	-	-	-	1	13	2	-	-	-	1
Medium mammal	1	4	1	-	3	26	15	51	13	1	16	1
Large mammal	-	1	2	-	1	7	17	76	5	3	19	-
Domestic fowl	-	-	-	-	5	13	14	39	-	-	1	-
Goose	-	-	-	-	-	5	-	8	1	-	-	1
Mallard	-	-	-	-	-	-	-	1	-	-	-	-
Grey heron	-	-	-	-	-	-	1	-	-	-	-	-
Lapwing	-	-	-	-	-	1	-	-	-	-	-	-
Lapwing cf.	-	-	-	-	-	1	-	-	-	-	-	-
Turkey	-	-	-	-	-	-	-	4	-	-	-	-
Pigeon/dove sp.	-	-	-	-	-	1	-	-	-	-	-	-
Raven	-	-	-	-	-	-	-	1	-	-	1	-
Woodcock	-	-	-	-	-	-	2	2	-	-	-	-
Woodcock cf.	-	-	-	-	-	-	1	1	-	-	-	-

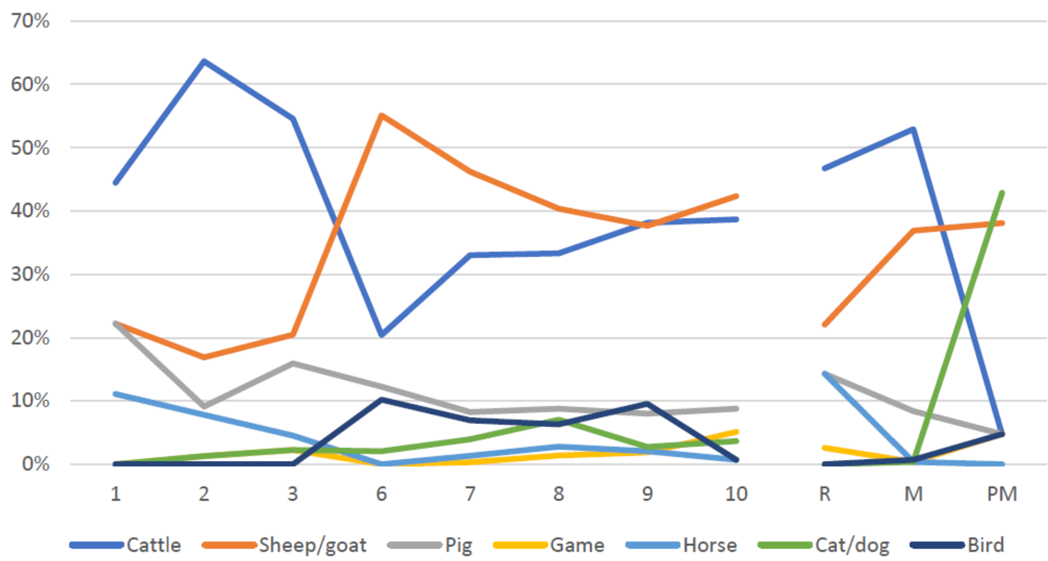


FIGURE 4.52: Frequencies by NISP of species and groups by phase from Paul Street

TABLE 4.70: MAU absolute counts and relative frequencies of major domesticates by phase from Paul Street

	2	7	8	9	10	R	M
Cattle	15.75	39.75	44.25	121.5	22.5	15	97.75
Sheep/goat	8	70.5	65	159.5	50	7	78.25
Pig	4.75	16.5	13.5	30.25	8.75	5	16.25
Cattle %	55	31	36	39	28	56	51
Sheep/goat %	28	56	53	51	62	26	41
Pig %	17	13	11	10	11	19	8

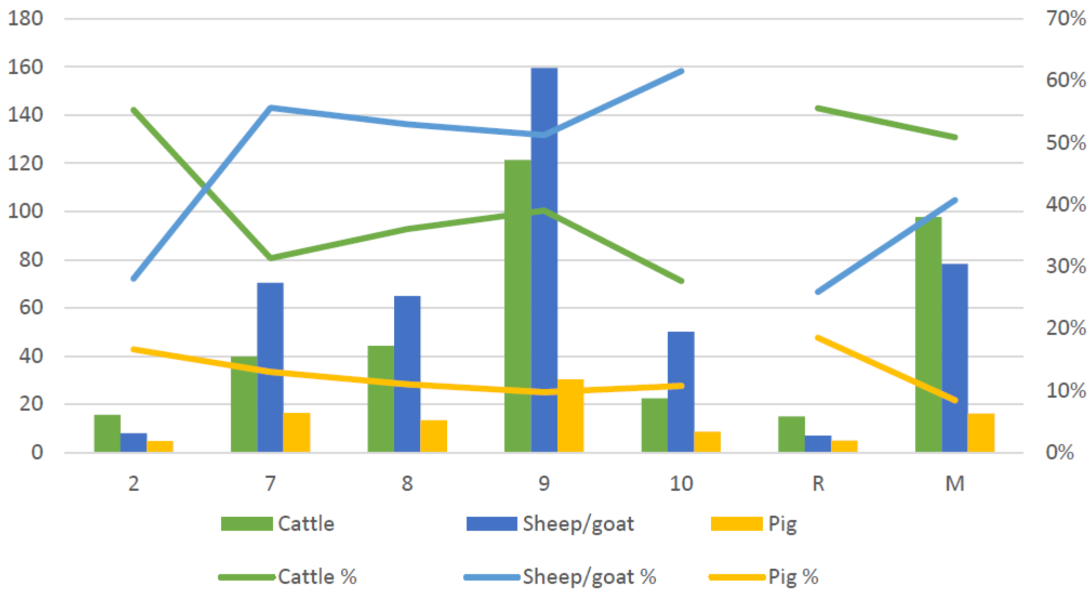


FIGURE 4.53: MAU absolute counts (primary axis) and relative frequencies (secondary axis) of major domesticates by phase from Paul Street

TABLE 4.71: Fragmentation counts and FFI scores by phase from Paul Street

Fracture	2	7	8	9	10	R	M
Fresh	3	28	39	89	30	8	46
Fresh + dry	0	1	1	0	1	0	1
Fresh + dry + mineralised	0	0	0	0	0	0	1
Fresh + mineralised	0	2	5	1	3	0	6
Dry	5	15	17	40	13	1	31
Dry + mineralised	1	1	0	4	0	0	1
Mineralised	11	58	61	106	19	7	115
Impact scar	0	1	0	3	3	0	2
FFI score	4.4	4.3	4.0	3.7	3.1	3.6	4.5
New break	7	38	35	105	27	19	56
New break/NISP ratio	1:12	1:9	1:9	1:7	1:6	1:4	1:6

Fragmentation: While the MAU suggests that there is minimal variation in frequencies of the animal species at Paul Street, the fracture history profile tells a different story about the approach to the bones themselves. In phase 2 approximately 15% of the NISP displays fresh fractures and around 30% have dry fractures (Figure 4.54). On the other hand, in phase R 50% has fresh fractures and only around 7% has dry fractures. As material from phase R cannot be associated with a specific time during the Roman occupation, unlike the material from phase 2, this discrepancy between the two phases seems to suggest that there is great variation within the material deposited in different contexts even when their dating overlaps. In comparison, the trends within the medieval (phases 7, 8, and M) and post-medieval phases (phases 9 and 10) are relatively stable. In the medieval ones, 25-35% are fresh fractures and 15-20% are dry fractures. In the post-medieval phases fresh fractures become increasingly more frequent with 38-52% while approximately 20% are dry fractures. Despite the fact that highest frequencies of fresh fractures are in phase R and 10, there are no impact scars recorded in phase R, whereas there are three in phase 10 (Table 4.71). This may indicate that the fresh fractures in phase 10 are more likely to be a result of fracturing for marrow. Similar to other Exeter sites, the fresh fracture to NISP ratios suggest that the excavators were more careful when working with the Roman military features in comparison to the earlier phases (Table 4.71).

Taphonomy: Apart from phase 10, the surface weathering of the faunal material has little variation over time (Table 4.72). Looking at the carnivore gnawing there are some clear

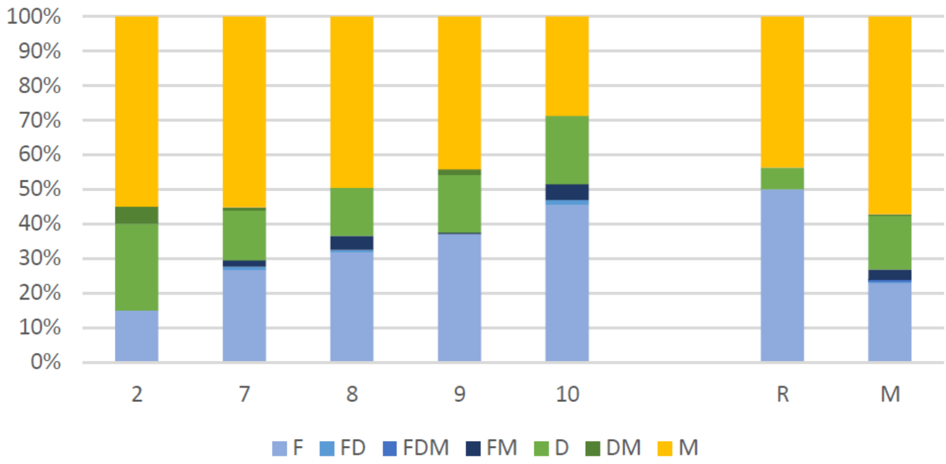


FIGURE 4.54: Fracture history profiles by phase from Paul Street

TABLE 4.72: Taphonomy absolute counts and frequencies by phase from Paul Street

Type	**2**	**7**	**8**	**9**	**10**	**R**	**M**
Carnivore gnawing	1	5	5	19	4	3	-
Rodent gnawing	-	-	1	-	1	-	-
Root etching	-	-	-	-	-	-	1
Staining	-	-	-	3	27	-	-
Burning – singed	3	2	5	4	1	13	25
Burning – charred	-	28	3	4	-	2	-
Burning – calcined	-	2	-	-	-	-	-
Carnivore gnawing	1.2%	1.5%	1.6%	2.6%	2.6%	3.7%	-
Burning (all)	3.7%	9.5%	2.5%	1.1%	0.6%	18.5%	8.1%
Weathering score	2.2	2.1	2.0	2.0	1.7	2.1	2.2

trends for the post-medieval phases, as well as phase 7 and 8. In both phase 9 and 10 2.6% of the total NISP exhibits signs of gnawing and in phase 7 and 8 it is 1.5% and 1.6%. If we assume that carnivores were present in equal amounts over time and that amount of gnawing is reflective of waste exposure time, this suggests that within the two time frames the phases represent, there were consistent waste disposal methods and that waste was disposed of quicker in the latter half of the medieval period than in the post-medieval period. In terms of burning there are no visible patterns, except that the post-medieval phases have less recorded cases than any of the other phases. Similar to Mermaid Yard, post-1800 activities have stained the bones in the upper stratigraphic layers.

Skeletal part abundance: Figures 4.55, 4.56, and 4.57 show the changing trends in skeletal part abundances for cattle, caprines, and pigs over time. Similar to all other sites from Exeter, there was a recovery bias against small elements and late fusing epiphyses. In the graphs, this is reflected in, for example, the low frequencies of distal metapodia, proximal humeri, and tarsals particularly for caprines and pigs. Based on the amounts of recorded taphonomy presented above, these processes are unlikely to have had a major influence on the skeletal part abundances, though carnivore gnawing should be kept in mind in the general Roman phase and potentially the post-medieval phases.

The trends for cattle in the two Roman phases suggest that only parts of the animals made it to the site (Figure 4.55). However, the small sample sizes for these phases are likely to have had an influence on these patterns. Nonetheless, in phase 2 it is clear that low utility elements, such as metapodia and tarsals, are the most frequent. In phase R, the pattern differs as humeri are particularly frequent and scapulae and tibiae are present in relatively high amounts as well. With the increase in assemblage size for the medieval phases, the patterns become more nuanced. Metapodia and tarsals are still frequent in phase 7, though it is in equal numbers to tibiae, humeri and radii. Moving into the late medieval period (phase 8) the meat-bearing bones are now starting to dominate which can be seen in the higher numbers of scapulae, humeri and radii, and mandibles are present in similar numbers. In the general medieval phase, humeri and radii are still among the most frequent, though tarsals and pelves are equally as frequent. The trends

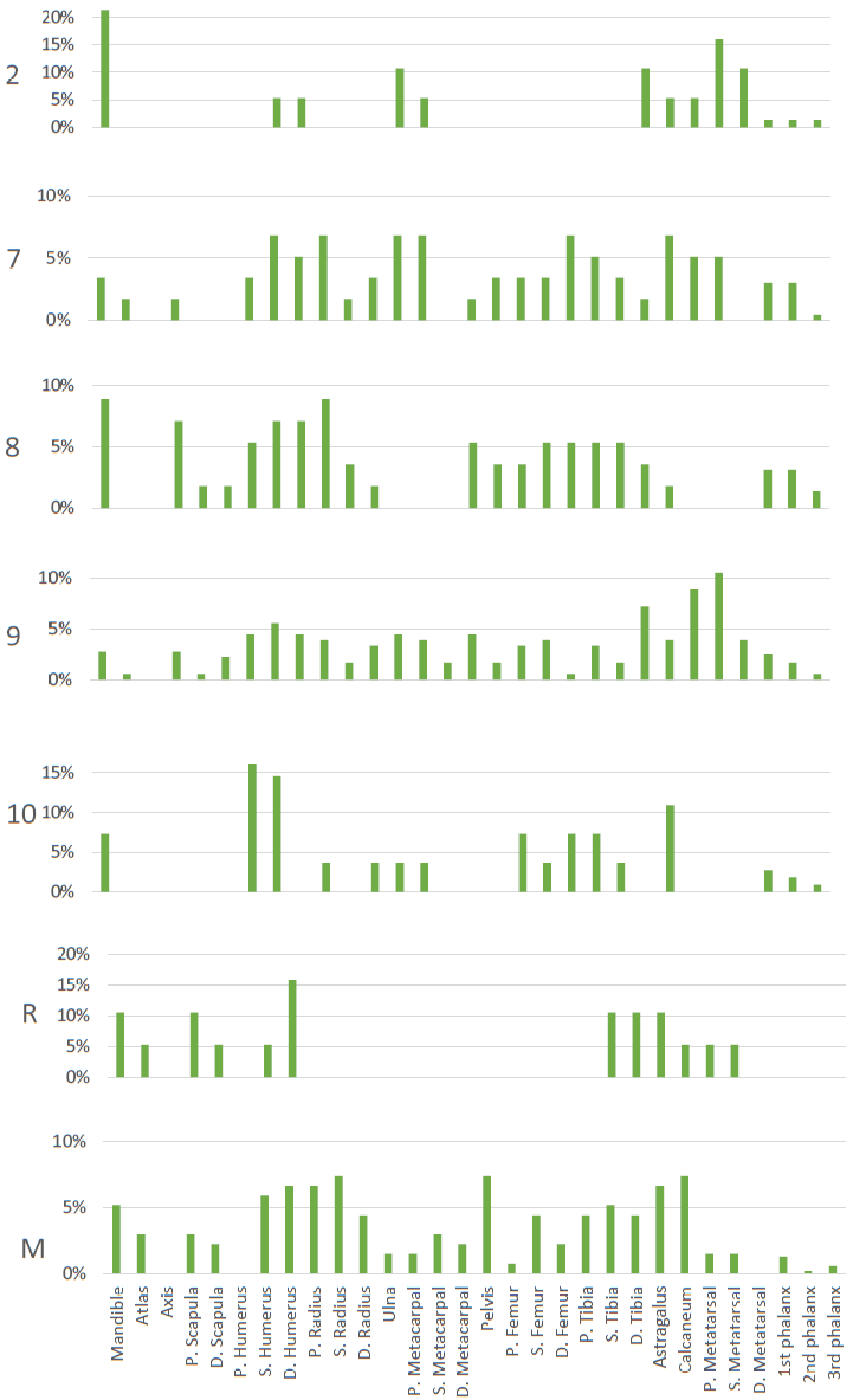


FIGURE 4.55: Cattle skeletal part abundances by MAU by phase from Paul Street

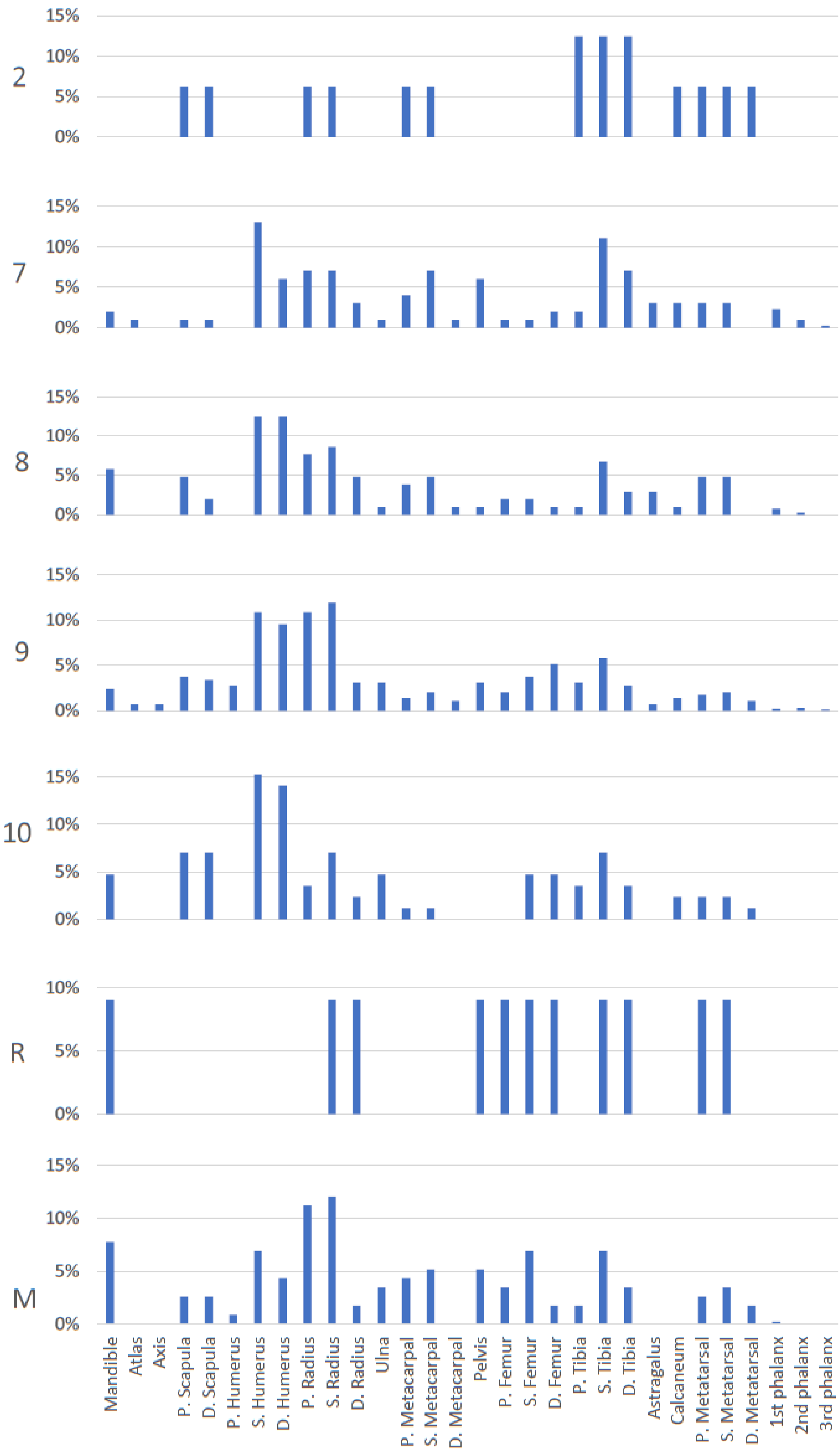


FIGURE 4.56: Caprines skeletal part abundances by MAU by phase from Paul Street

FIGURE 4.57: Pig skeletal part abundances by MAU by phase from Paul Street

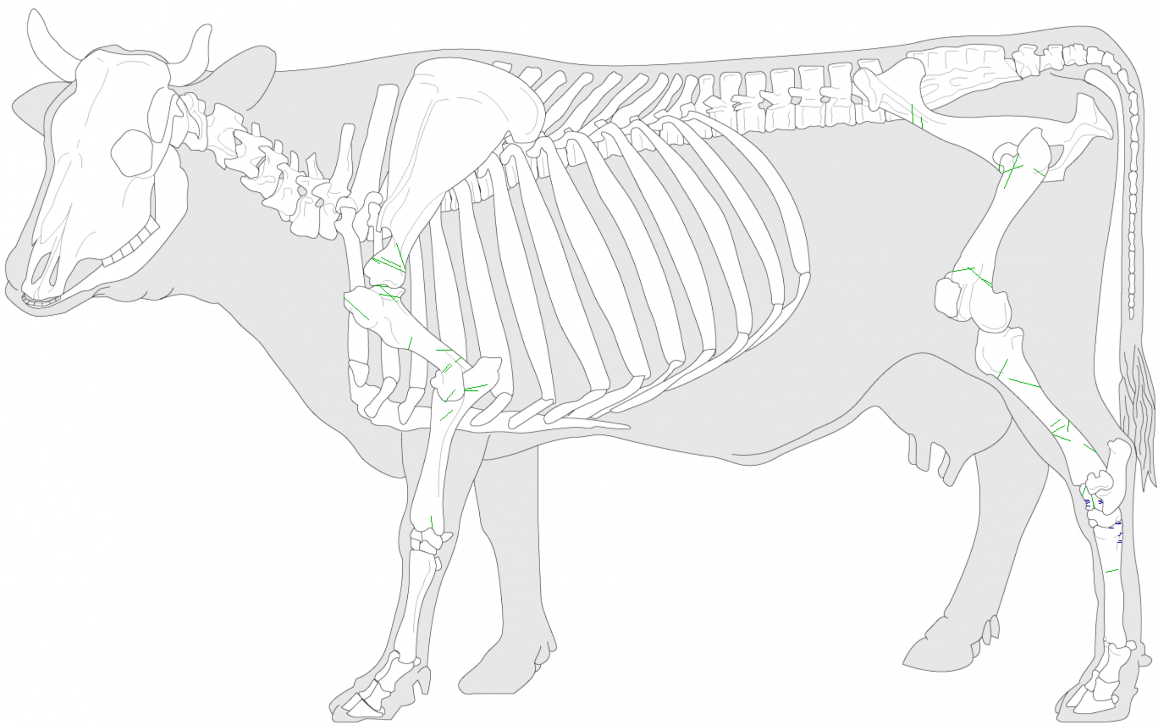


FIGURE 4.58: Cattle butchery from phase 9 at Paul Street

for phase 9 show a clear shift. Metatarsals and astragali are the most frequent and all other parts are present in almost equal numbers when the recovery biases have been taken into consideration. Though, in phase 10, humeri are once again the most frequent.

The trends for caprines are noticeably different from those of cattle as meat-bearing elements dominate in almost all phases (Figure 4.56). The assemblage sizes for the two Roman phases are very small, but the phase 2 material shows tibiae dominating, while the general Roman material stands out by having no variation in frequencies between the present elements. Phase 7 and 8 have very similar patterns where humeri, radii and tibiae dominate and in the general medieval phase, radii are clearly favoured. In phase 9, the medieval patterns become even more pronounced, and humeri and radii are now at least twice as frequent as any other element. Phase 10 follows the same trend, though humeri dominate.

Similar to the caprines, the skeletal part abundances for pigs show meat-bearing bones to be the most frequent in most phases (Figure 4.57). Phase 7 stands out as tarsals and mandibles are the most frequent, though closely followed by radii and ulnae. In phase 8 scapulae, humeri, radii and in particular ulnae are the most frequent, whereas

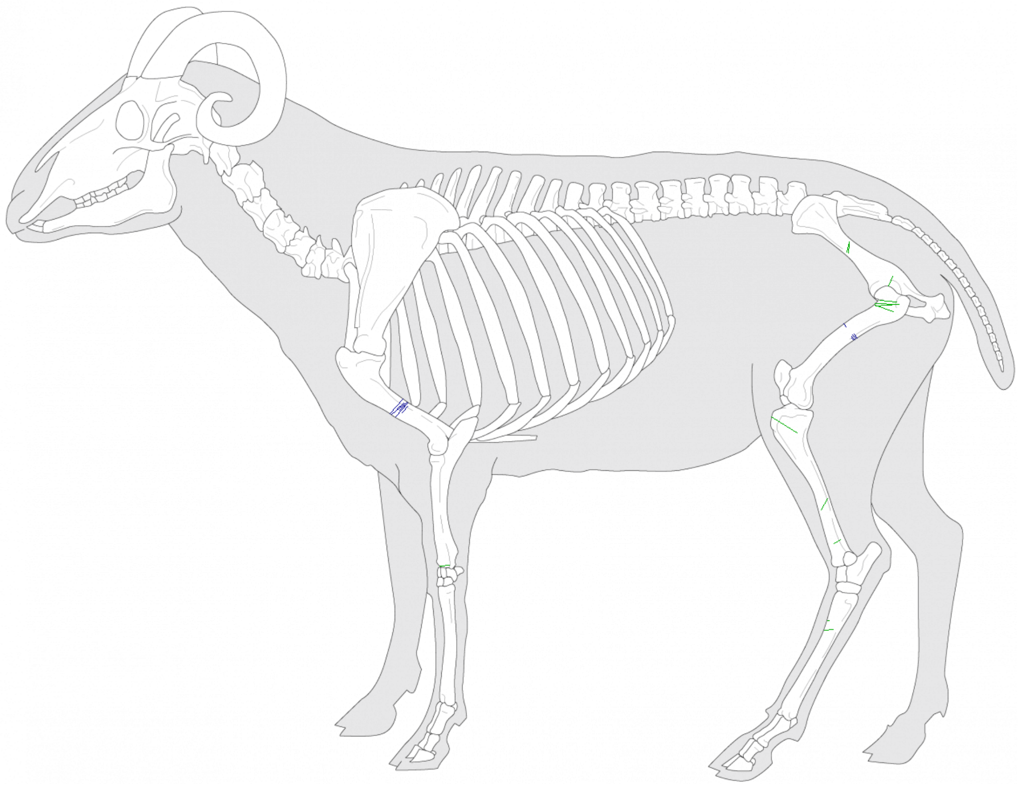


FIGURE 4.59: Caprine butchery from phase 9 at Paul Street

the low utility elements are either in low numbers or absent. Tibiae is the dominant element in the general medieval phase, though it shifts back to humeri and radii as well in phase 9, and in phase 10, radii and ulnae are the most numerous.

Butchery: Only phase 9 has enough recorded cases of butchery to be included here. A total of 89 cases were recorded, 38 of these were on cattle remains, 17 on caprine, 12 on medium mammal, 19 on large mammal, and only single cases were recorded on pig, domestic fowl, and dog. On cattle, the marks are located above or below the cancellous ends of the long bones, whereas the cut marks are located on or below the tarsals suggesting that some disarticulation was happening by knife rather than by cleaver (Figure 4.58). Caprines show a slightly different trend. Chop marks are mainly located on the proximal end of the femur, suggesting that the hind legs were separated from the body at the pelvis (Figure 4.59). The cut marks around the central humerus and femur possibly indicate that the meat joints were trimmed. The chop marks on vertebrae from large and medium mammals also show different patterns (Figure 4.60 and 4.61). While almost all marks are likely to be from separating the animals into left and right halves, there is much more variation in the angles and locations in medium mammals compared to the very consistent patterns seen in large mammals.

Aging - fusion: The relative proportions of stage 4 fused and unfused elements in cattle, caprines, and pigs show clear differences in the slaughter ages. Stage 4 is the final fusion stage, so the data presented in Figure 4.62, 4.63, and 4.64 show the proportion of animals that had fully fused skeletons against the ones that died before this stage. Only very few pigs survived to full skeletal maturity, indicating that they were all reared for meat (Figure 4.64), whereas cattle and caprines show much more variability over time. No data are available for the Roman Civil period (phase 2) for cattle, though the general Roman phase indicated that cattle were used for both meat and secondary products which continued throughout medieval period (Figure 4.62). In the post-medieval phases (9 and 10) there was a shift towards rearing for meat, though still with some use for secondary products. Caprines show almost the opposite pattern (Figure 4.63). In the Roman Civil periods, they were used exclusively for secondary products, but by the high medieval period (phase 7), there has been a shift towards meat, and in the late medieval (phase 8) and post-medieval periods, there was a mixed economy, with some rearing for meat but the main focus had returned to secondary products.

Aging - dental wear: Table 4.73, 4.74, and 4.75 presents absolute counts for the number of mandibles of cattle, caprines, and pigs at each wear stage. There are too few data available from this site to be presented here.

Sex: Table 4.76 presents the absolute counts for identified male and female cattle, caprines, and pigs. For the phases and species where data are present, males are typically more frequent than females, though these trends may be heavily biased by the difficulties in identifying sex in faunal remains.

Metrics: Summaries of the measurements from cattle and caprines are presented in Table 4.77 and 4.78. Phases with fewer than five measurements from a species have not been included here.

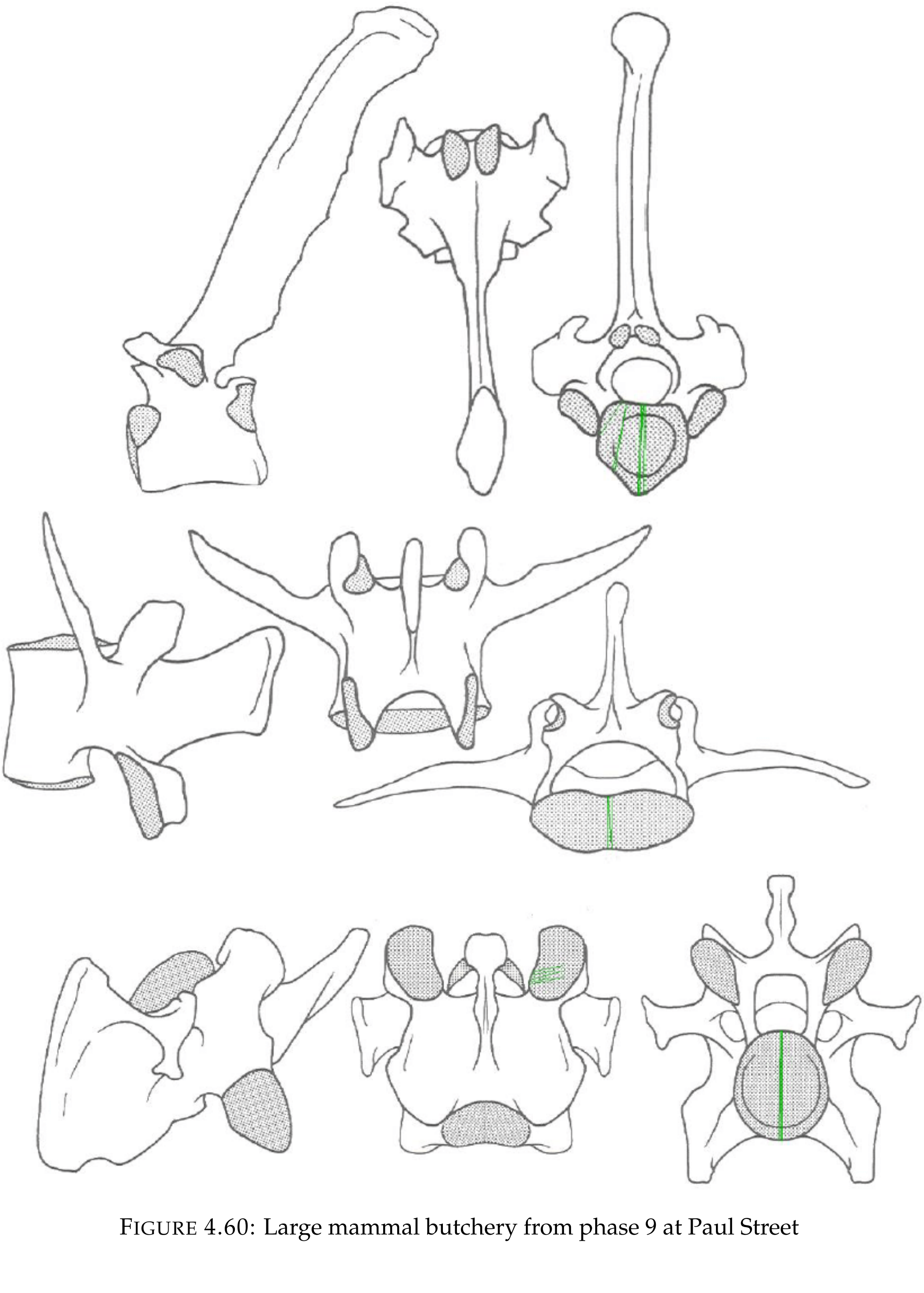


FIGURE 4.60: Large mammal butchery from phase 9 at Paul Street

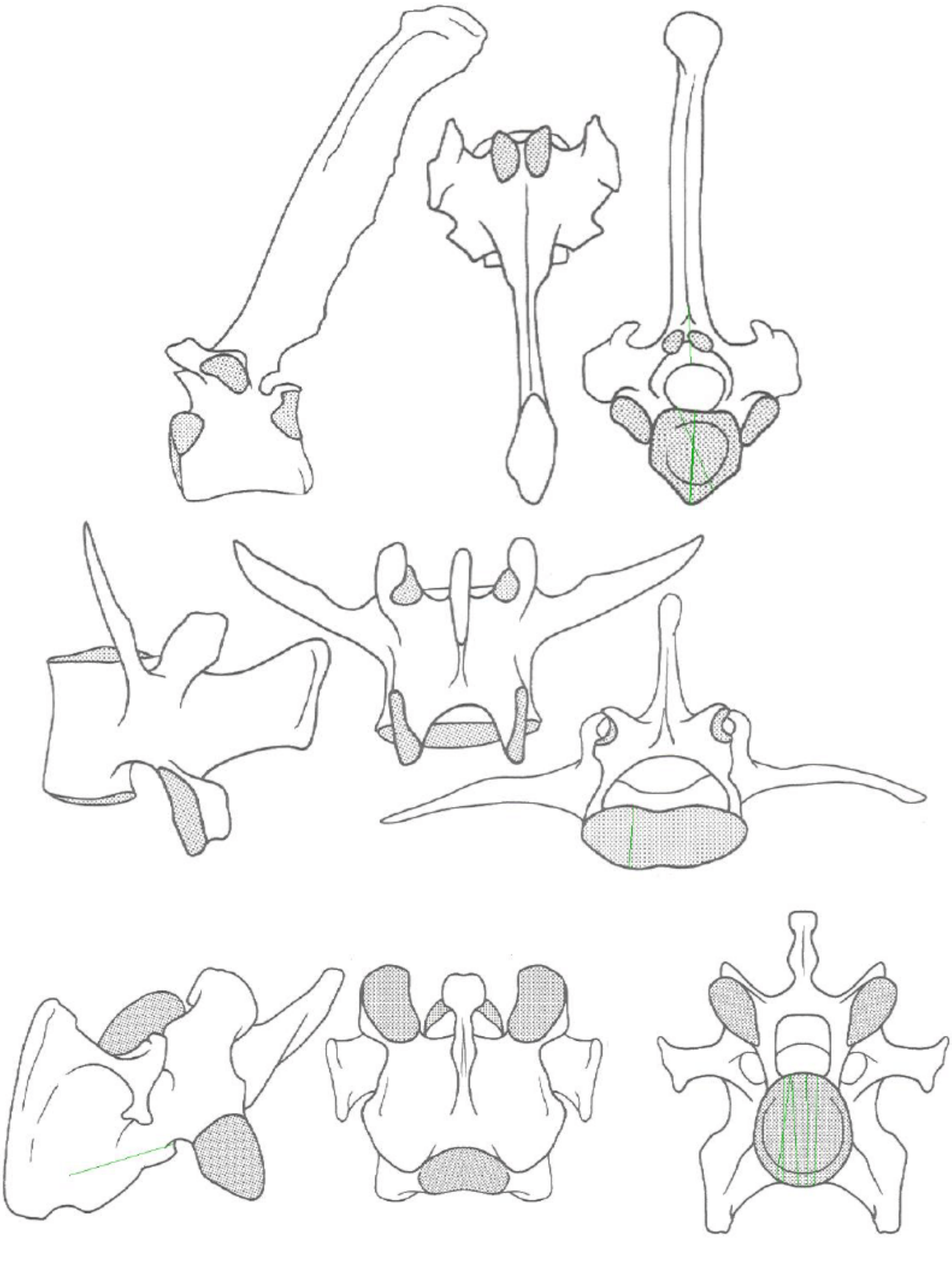


FIGURE 4.61: Medium mammal butchery from phase 9 at Paul Street

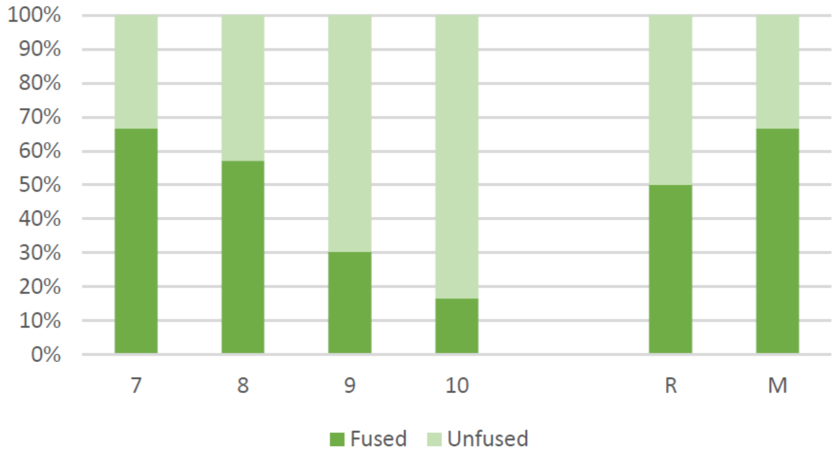


FIGURE 4.62: Stage 4 cattle fusion by phase from Paul Street

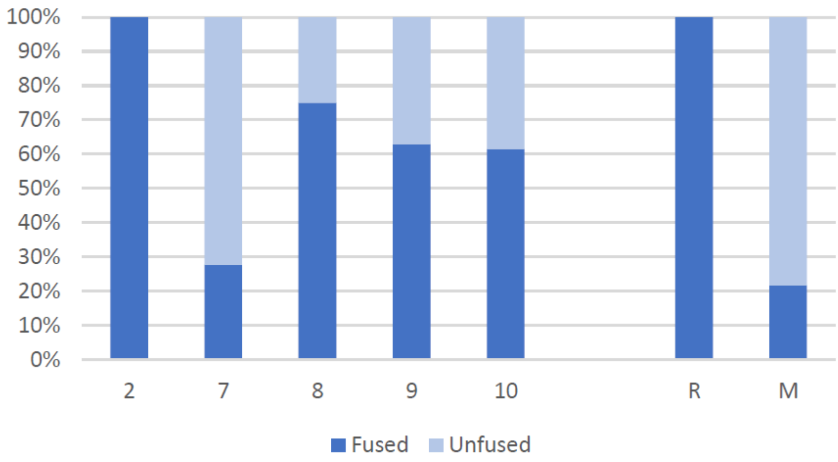


FIGURE 4.63: Stage 4 caprine fusion by phase from Paul Street

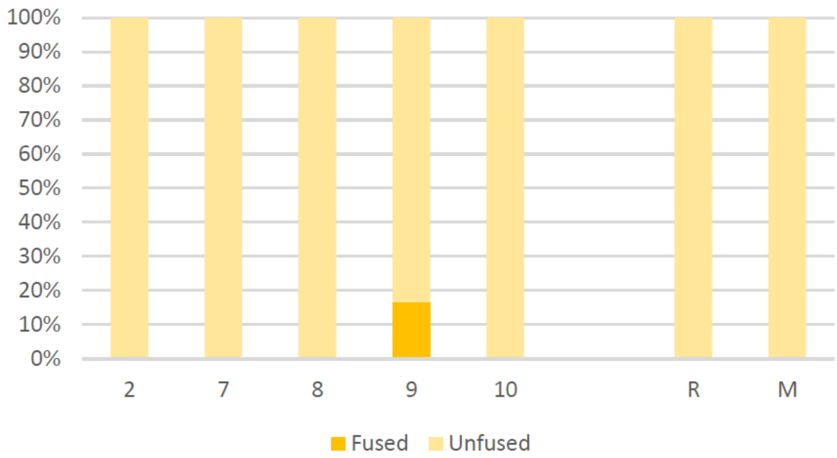


FIGURE 4.64: Stage 4 pig fusion by phase from Paul Street

TABLE 4.73: Cattle tooth wear by phase from Paul Street

Wear stage	2	7	8	9	10	R	M
A	-	-	-	-	-	-	-
B	-	-	1	2	1	-	-
C	-	-	-	-	1	-	-
D	-	-	-	-	-	-	-
E	-	-	-	-	-	-	-
F	-	-	-	1	-	-	-
G	1	-	1	1	-	-	1
H	-	-	-	-	-	-	1
I	-	-	1	-	-	-	-

TABLE 4.74: Caprine tooth wear by phase from Paul Street

Wear stage	2	7	8	9	10	R	M
A	-	-	-	-	-	-	-
B	-	-	-	-	-	1	-
C	-	-	-	-	1	-	-
D	-	-	-	-	-	-	2
E	-	1	-	1	1	-	-
F	-	-	-	2	1	-	2
G	-	1	1	1	-	-	1
H	-	-	1	-	-	-	1
I	-	-	-	-	-	-	-

TABLE 4.75: Pig tooth wear by phase from Paul Street

Wear stage	2	7	8	9	10	R	M
A1	-	-	-	1	-	-	-
A2	-	-	-	-	-	-	-
A3	-	-	-	-	-	-	-
B	-	1	-	1	-	-	-
C	-	-	-	-	-	-	-
D	-	-	-	-	1	-	-
E	-	-	-	-	-	-	-
F	-	-	-	-	-	-	-
G	-	-	-	-	-	-	-

TABLE 4.76: Absolute counts of sex for major domesticates by phase from Paul Street

		2	7	8	9	10	R	M
Cattle	Male	-	-	1	-	-	-	1
	Female	-	-	-	-	-	-	2
Caprines	Male	-	3	-	1	-	2	2
	Female	-	-	-	-	-	-	1
Pig	Male	-	2	1	1	-	1	3
	Female	-	1	-	1	-	-	-

TABLE 4.77: Summary of cattle measurements from Paul Street, with number of specimens, average, minimum and maximum measurements

Cattle		Phase 7				Phase 9				Phase M			
Element	Measurement	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.
Astragalus	GL1					*2*	64,78	61,49	68,06	*3*	55,15	51,05	59,82
Femur	Bd												
	Bp												
	GL												
	SD												
Horncore	Greatest (o-a)					*1*	79,43	79,43	79,43	*3*	40,77	34,76	45,96
	Least (d-b)					*1*	55,34	55,34	55,34	*3*	32,12	26,45	36,77
Humerus	Bd					*1*	74,67	74,67	74,67	*1*	67,33	67,33	67,33
	Bp												
	GL												
	SD												
Metacarpal	Bd					*3*	61,44	55,68	67,18	*2*	54,41	44,82	63,99
	Dd					*3*	32,33	27,29	36,62	*2*	28,65	24,36	32,93
	Bp	*2*	51,7	51,04	52,36	*7*	57,53	52,63	67,54	*2*	55,49	49,42	61,56
	GL					*3*	198,17	179,5	208	*1*	198	198	198
	SD					*3*	34,06	32,18	37,79	*1*	36,21	36,21	36,21
Metatarsal	Bd					*7*	52,67	44,8	62,09				
	Dd					*6*	29,64	24,71	33,05				
	Bp	*1*	44,29	44,29	44,29	*8*	49,02	45,71	51,64				
	GL					*4*	220,5	208	233				
	SD					*5*	28,19	25,37	30,5				
M3	Length					*2*	34,69	33,92	35,45	*1*	34,55	34,55	34,55
Radius	Bd									*1*	63,14	63,14	63,14
	Bp	*1*	59,71	59,71	59,71	*1*	73,8	73,8	73,8	*1*	67,64	67,64	67,64
	GL												
	SD												
Scapula	GLP					*1*	75,37	75,37	75,37	*1*	55,69	55,69	55,69
Tibia	Bd	*1*	56,77	56,77	56,77	*1*	56,05			*2*	53,63	49,21	58,05
	Bp												
	GL												
	SD												

TABLE 4.78: Summary of caprine measurements from Paul Street, with number of specimens, average, minimum and maximum measurements

Caprine		Phase 7				Phase 8				Phase 9				Phase 10				Phase M			
Element	Measurement	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.
Astragalus	GL1	*1*	27,3	27,3	27,3					*1*	29,45	29,45	29,45								
Femur	Bd									*2*	36,61	34,95	38,27								
	Bp																				
	GL																				
	SD																				
Horncore	Greatest (o-a)	*2*	30,2	27,68	32,71													*3*	36,71	27,81	50,57
	Least (d-b)	*2*	19,17	18,96	19,37													*3*	23,36	17,37	34,06
Humerus	Bd	*1*	25,21	25,21	25,21	*4*	28,32	27,84	29,14	*13*	28,85	24,97	32,21	*7*	29,52	28,16	31,24	*3*	27,76	27,26	28,67
	Bp									*2*	36,15	35,52	36,78								
	GL									*1*	126,24	126,24	126,24								
	SD									*1*	15,19	15,19	15,19								
Metacarpal	Bd					*1*	23,8	23,8	23,8	*2*	23,55	23,38	23,71								
	Dd					*1*	14,47	14,47	14,47	*2*	14,77	14,71	14,82								
	Bp	*1*	19,35	19,35	19,35	*1*	21,34	21,34	21,34	*4*	20,87	20,13	21,98	*1*	22,71	22,71	22,71	*1*	22,02	22,02	22,02
	GL					*1*	110,66	110,66	110,66	*2*	108,39	106,7	110,07								
	SD					*1*	11,71	11,71	11,71	*2*	12,92	12,78	13,06								
Metatarsal	Bd									*2*	22,79	21,51	24,06	*1*	22,2	22,2	22,2	*1*	20,81	20,81	20,81
	Dd									*2*	14,12	13,82	14,41	*1*	14,32	14,32	14,32	*1*	14,55	14,55	14,55
	Bp	*2*	19,16	18,83	19,48	*3*	19,62	18,86	20,8	*5*	20,2	18,8	21,73	*1*	18,46	18,46	18,46	*2*	18,13	18	18,26
	GL									*2*	116,3	114,18	118,41	*1*	120,3	120,3	120,3				
	SD									*1*	11,22	11,22	11,22	*1*	10,2	10,2	10,2				
M3	Length																				
Radius	Bd	*1*	26,53	26,53	26,53	*4*	26,25	24,95	27,39	*7*	26,59	25,83	27,52	*2*	27,57	26,89	28,24				
	Bp	*1*	19,55	19,55	19,55	*3*	30,16	28,32	32,55	*17*	29,46	25,67	33,93	*3*	34,14	32,67	36,63	*5*	29,76	28,01	31,6
	GL	*1*	144,67	144,67	144,67	*2*	141,52	141,23	141,8	*6*	138,97	133,24	148,11								
	SD	*1*	15,83	15,83	15,83	*2*	15,33	15,12	15,54	*7*	15,63	13,97	16,3								
Scapula	GLP					*2*	31,78	31,53	32,03	*5*	32,54	31,16	34,12	*1*	33,15	33,15	33,15				
Tibia	Bd	*2*	24,47	24,31	24,62	*2*	24,32	24,05	24,59	*6*	26,28	24,22	28,01	*3*	27,07	25,25	28,64				
	Bp									*2*	38,5	37,68	39,31								
	GL																				
	SD																				

4.11 Queen Street (QS)

RAMM accession number: 35/2005

Exeter archive site 68

Excavation year: 1978

North Quarter

4.11.1 Site description

The Queen Street excavation was undertaken in 1978 by the Exeter Museums Archaeological Field Unit prior to the construction of a new store (Bedford and Salvatore n.d. b). The site is located within the northern part of the military fortress in the area of the Old Wool Market. Remains of the Roman Civil, medieval, and post-medieval periods were recorded overlying the Roman military deposits. Remains of at least four military phase buildings, likely barracks, were found on the side of a metalled road (Bedford and Salvatore n.d. b). The Roman Civil features are similar to the previous period with a road running through the middle of the site and parts of buildings on either side (John Allan pers. comm.). In the post-Roman centuries there was no structural evidence, but 11^{th} to 13^{th} century pits and later medieval and post-medieval pig groups cut into post-Roman garden soil. These pits include a garderobe pit group of c. 1600 with imported porcelain and stoneware from as far away as China (Allan 1984; John Allan pers. comm.).

4.11.2 The faunal remains

In terms of assemblage size, the Queen Street excavation produced the largest amount of faunal material out of the 10 sites included in this thesis. Over 10,000 specimens were examined, 4020 could be identified to species or family level, 283 were fish, and the remaining 6237 could not be identified to species level. The majority of the material dates to phase 7 and 9, though faunal remains were recovered from all phases apart from phase 10 (Table 4.79). Cattle are, as always, the most frequent species in most phases, though caprines, pigs and birds also occur in high proportions in various phases (Table 4.80 and Figure 4.65). Particularly in phase 8 and 9 do bird specimens occur in equal numbers to cattle and caprines, mainly due to large numbers of domestic fowl (Table 4.80). The spike

TABLE 4.79: Fragment counts by phase from Queen Street

Phase	NISP	Fish	Unidentifiable
1	7	-	13
2	117	-	153
3	66	-	83
5	133	4	307
6	373	6	624
7	1504	62	2297
8	65	56	4
9	809	178	1384
R	7	-	7
M	426	17	554
PM	103	4	141
Undated	410	8	618

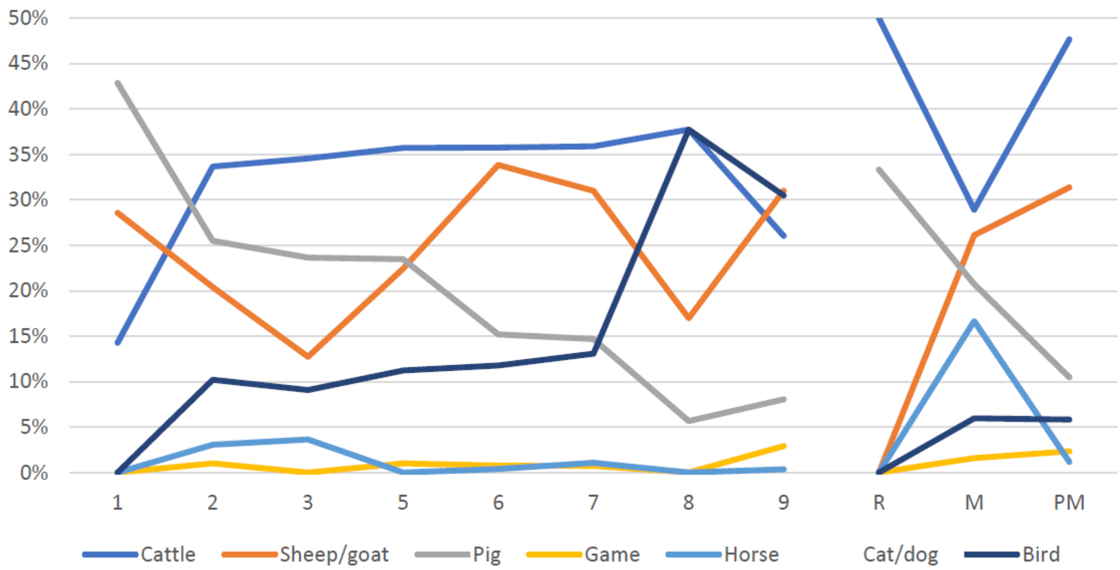


FIGURE 4.65: Frequencies by NISP of species and groups by phase from Queen Street

in cat/dog in phase 3 and R is caused by the very small NISP for phase R and four dog cranial specimens in phase 3. One specimen is an almost complete skull, but the remaining three specimens could not be fitted together. Similarly, there is an increase in horse specimens in phase M. Over half the specimens are teeth and another 7 are femora fragments from a minimum of two individuals. As the only group, game frequencies stay relatively stable over time, though with a slight increase towards phase 9.

MAU: When looking at MAU comparative to NISP for cattle, caprines and sheep, caprines are now the most frequent species in four out of the seven phases included below (Table 4.81 and Figure 4.66). In phase 2, cattle are the most frequent, but see a slow decline

TABLE 4.80: Fragment counts of species by phase from Queen Street

Species	1	2	3	5	6	7	8	9	R	M	PM
Cattle	1	33	19	35	94	398	20	152	3	92	41
Sheep/goat	2	17	7	19	83	318	7	177	-	73	26
Pig	3	25	13	23	40	163	3	47	2	66	9
Sheep	-	2	-	1	2	10	1	2	-	4	-
Goat	-	1	-	2	4	16	1	2	-	6	1
Cat	1	-	-	6	5	32	1	6	-	-	-
Dog	-	6	9	-	1	7	-	1	1	-	1
Roe deer	-	-	-	1	-	3	-	1	-	2	2
Fallow deer	-	-	-	-	-	-	-	2	-	1	-
Red deer	-	1	-	-	1	1	-		-	1	-
Rabbit	-	-	-	-	-	-	-	13	-	-	-
Hare sp.	-	-	-	-	1	4	-	1	-	1	-
Horse	-	3	2	-	1	12	-	2	-	53	1
Rat sp.	-	-	-	-	-	-	-	6	-	-	-
Rat sp. cf.	-	-	-	-	-	-	-	1	-	-	-
Mole	-	-	-	-	-	-	-	1	-	-	-
Pine marten	-	-	-	-	1	-	-	-	-	-	-
Common Lobster	-	-	-	-	-	-	1	-	-	-	-
Small mammal	-	-	-	1	-	23	-	21	-	-	-
Medium mammal	-	15	5	22	60	209	10	156	-	46	55
Large mammal	-	4	6	12	47	163	1	60	1	62	12
Domestic fowl	-	7	5	6	25	103	14	88	-	11	5
Domestic fowl cf.	-	-	-	1	2	9	1	38	-	-	-
Goose	-	-	-	2	3	13	3	10	-	7	-
Goose cf.	-	-	-	-	-	-	1	1	-	-	-
Mallard	-	-	-	-	-	2	1	3	-	-	-
Pheasant	-	-	-	-	-	-	-	-	-	1	-
Gull	-	-	-	-	-	-	-	1	-	-	-
Cormorant	-	-	-	-	-	-	-	1	-	-	-
Red grouse	-	-	-	-	-	1	-	-	-	-	-
Thrush	-	-	-	-	-	-	-	22	-	-	-
Raven	-	3	-	-	1	14	-	-	-	-	-
Raven cf.	-	-	-	-	-	1	-	-	-	-	-
Crow	-	-	-	-	-	1	-	-	-	-	-
Woodcock	-	-	-	2	-	-	-	2	-	-	-
Woodcock cf.	-	-	-	-	-	1	-	1	-	-	-
Bird of prey	-	-	-	-	-	-	-	1	-	-	-
Avian	-	-	-	-	-	-	-	10	-	-	-

TABLE 4.81: MAU absolute counts and relative frequencies of major domesticates by phase from Queen Street

	2	5	6	7	9	M	PM
Cattle	27	24.75	62	246	85.75	65	25.25
Sheep/goat	18	22	72	277.25	147.25	72.75	21
Pig	11.75	17.75	26.75	108.25	31.75	39.5	16.25
Cattle %	48	38	39	39	32	37	40
Sheep/goat %	32	34	45	44	56	41	34
Pig %	21	28	17	17	12	22	26

over time towards phase 9 and only increase slightly in the general post-medieval phase. While the numbers of caprines vary more, the trend is similar to cattle, though the relative amount of caprine in the assemblages increases from phase 2 to 9, but sees a 22% drop in phase PM. Pigs are at their most abundant in phase 5, however, they are at all times the least frequent of the three species (Table 4.81 and Figure 4.66).

Fragmentation: The fracture history profiles for the seven phases show a consistent increase in fresh fractures over time from approximately 20% in phase 2 to 50% in phase PM (Table 4.82 and Figure 4.67). The only outlier is phase 5 which has the second highest frequency of fresh fractures with nearly 40%. Impact scars are also recorded in each phase suggesting that at least some of the fractures are related to marrow extraction. The mineralised fractures have a similar pattern to fresh fractures, but dry fractures show slightly more variation. The only pattern visible for the dry fractures is that the higher the percentage of fresh fractures the lower the percentage of dry fractures becomes, though there is some variability within this pattern.

Taphonomy: The consistency in weathering score averages suggests that over time the bones had similar length of exposure to the elements (Table 4.83). There are only two slight outliers. Phase 5 has an average of 1.9 which may have been influenced by the high proportion of heat exposure. Phase 9 has a slightly lower than typical average at 1.5 suggesting that these bones were deposited in the ground quicker than in the other phases. As at other Exeter sites, there is no correlation between phase and proportion of specimens exposed to heat. The proportion is heavily influenced by single contexts that appear to have been exposed to a heat source. A good example of this is phase 5 where 62 of the 67 specimens with signs of heating are from the same context, only nine

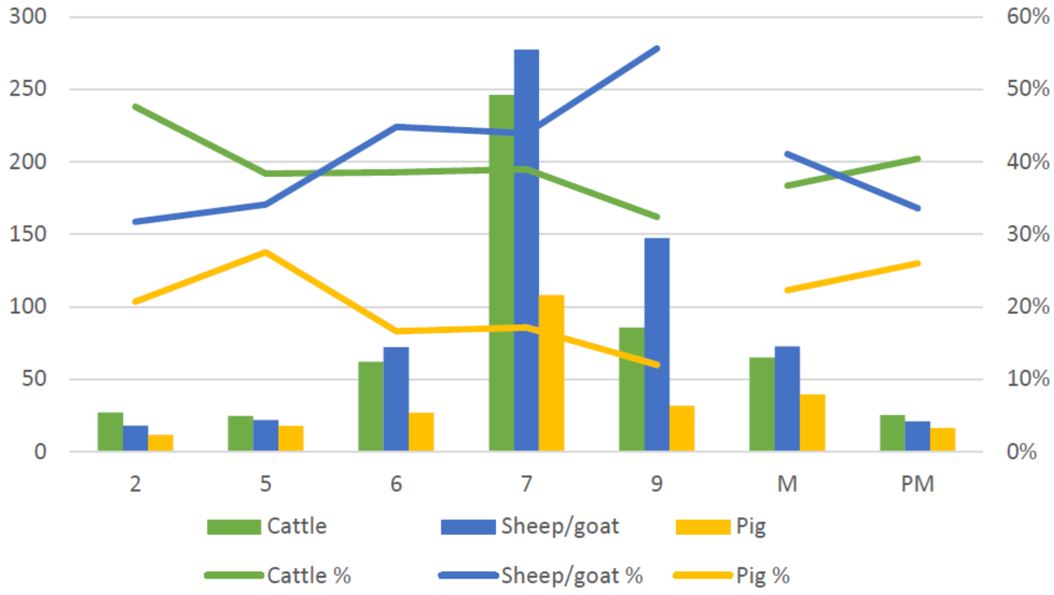


FIGURE 4.66: MAU absolute counts (primary axis) and relative frequencies (secondary axis) of major domesticates by phase from Queen Street

TABLE 4.82: Fragmentation counts and FFI scores by phase from Queen Street

Fracture	2	5	6	7	9	M	PM
Fresh	13	24	42	194	70	45	28
Fresh + dry	0	1	0	3	0	1	0
Fresh + dry + mineralised	0	0	0	0	0	0	0
Fresh + mineralised	2	0	3	9	0	4	0
Dry	13	8	31	99	34	31	5
Dry + mineralised	4	0	2	10	2	4	0
Mineralised	39	31	89	336	91	67	23
Impact scar	2	2	5	13	5	2	2
FFI score	4.5	3.9	4.3	4.1	3.8	4.1	3.7
New break	12	37	30	188	89	98	19
New break/NISP ratio	1:10	1:4	1:12	1:8	1:9	1:4	1:5

TABLE 4.83: Taphonomy absolute counts and frequencies by phase from Queen Street

Type	2	5	6	7	9	M	PM
Carnivore gnawing	12	14	16	96	23	23	8
Rodent gnawing	-	-	-	1	3	-	-
Insect damage	-	-	-	2	-	1	-
Burning – singed	13	57	36	161	6	23	4
Burning – charred	2	8	11	51	9	4	1
Burning – calcined	-	2	-	1	3	1	-
Carnivore gnawing	10.3%	10.5%	4.3%	6.4%	2.8%	5.4%	7.8%
Burning (all)	12.8%	50.4%	12.6%	14.2%	2.2%	6.6%	4.9%
Weathering score	1.6	1.9	1.7	1.6	1.5	1.7	1.6

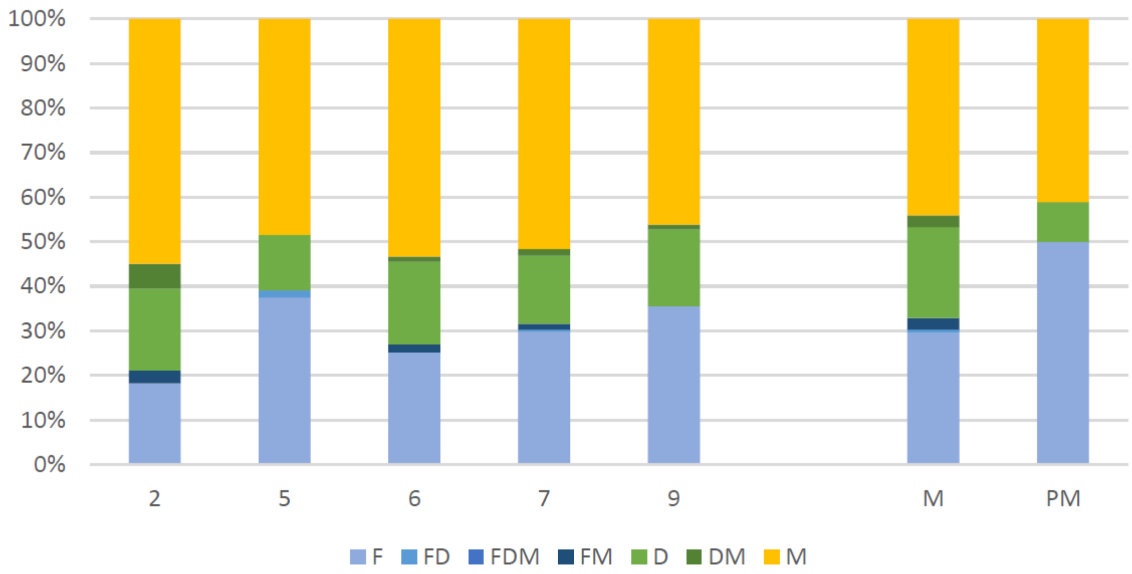


FIGURE 4.67: Fracture history profiles by phase from Queen Street

specimens from this context do not exhibit signs of burning. The proportions of carnivore gnawing are less related to specific contexts, so the percentages suggest that bones were more likely to be gnawed by dogs and other carnivores before the Norman Conquest than after.

Skeletal part abundance: As at the other Exeter sites included in this thesis, the skeletal part abundances indicate that there was a recovery bias against small elements and late fusing epiphyses such as tarsals, distal radii and distal metapodia (Figure 4.68, 4.69, and 4.70). Caprines and pigs are affected by this bias in a higher degree than cattle. Epiphyses of long bones may be less frequent in phase 2 and 5 due to the larger proportion of specimens with carnivore gnawing (Table 4.83). In general, the whole body is represented for all three species, though there are a few exceptions which will be noted below under the relevant species.

For cattle there is a clear selection for scapulae during phase 2 while the other recovered elements are present in fairly equal amounts (Figure 4.68). Moving into phase 5, metapodia are absent and the only indicators that lower legs were brought to the site are tarsals and a few phalanges. The majority of skeletal parts at the site during this period are meat-bearing long bones suggesting that the deposits are food waste. The abundances for phase 6, 7, M, and 9 are all relatively similar as there is a fairly even representation of elements from across the body with only minor variations over time. The

FIGURE 4.68: Cattle skeletal part abundances by MAU by phase from Queen Street

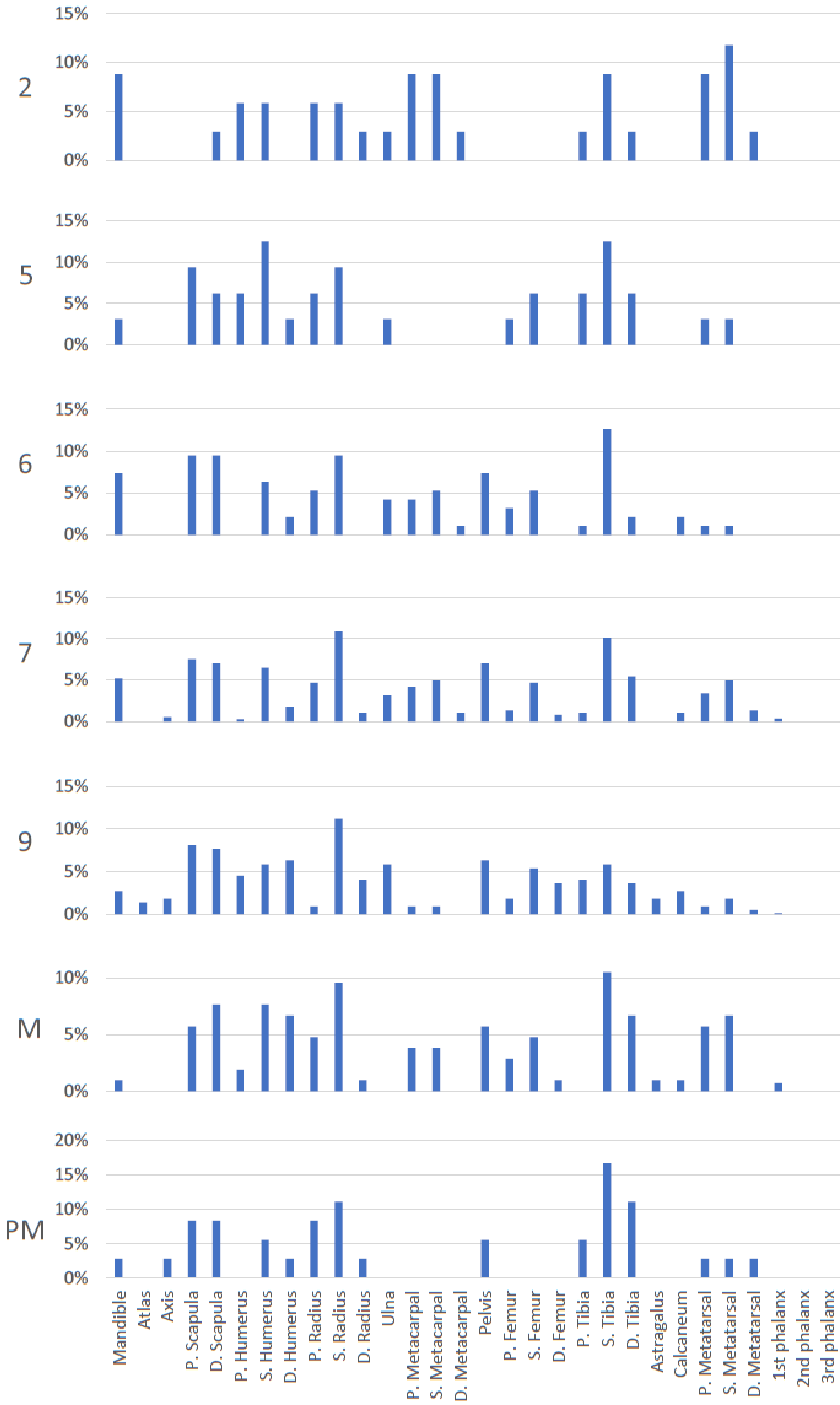


FIGURE 4.69: Caprine skeletal part abundances by MAU by phase from Queen Street

FIGURE 4.70: Pig skeletal part abundances by MAU by phase from Queen Street

general post-medieval phase is similar to the previous phases, though there is once again a lack of metapodia relative to the amounts of other elements.

As mentioned above, caprines are more affected by the recovery biases comparative to cattle, which is reflected in all phases of Figure 4.69. In phase 2 metatarsals are the most frequent elements, followed by metacarpals, mandibles and tibiae. In phase 5 the most frequently occurring elements are meat bearing long bones e.g. humeri, tibiae, scapulae, and radii. The preference for these types of elements continues throughout the remaining phases, with radii and tibiae usually being the most frequent elements. Furthermore, there are notably low numbers, or a complete absence, of metapodia, tarsals and phalanges in these phases.

In phase 2 there is an unusually high proportion of pig metatarsal comparative to the other all later phases (Figure 4.70). More in keeping with the other phases are the high frequencies of radii and ulnae. Phases 6, 7, and M all have high proportions of tibiae, whereas humeri are the most frequent elements in phase 9 and PM. These trends indicate that throughout the medieval and post-medieval phases, the Queen Street deposits contained food waste.

Butchery: Only phase 7 and 9 have enough recorded butchery to be included here. Phase 7 has 102 cases, 60 of these were located on cattle remains, 20 on caprine, and the remaining divided between pig, goose, chicken, and medium and large mammal. Phase 9 has 106 cases, 21 of these were located on cattle remains, 20 on caprine, 17 on large mammal specimens, 41 on medium mammal specimens, and the remaining 7 cases were on pig, chicken, and goose remains. In phase 7, the majority of butchery marks on cattle were located around the humerus-radius joint and on the pelvis (Figure 4.71), whereas on caprines, they were often located on the distal shaft of the tibia and around the bases of horns (Figure 4.72 and 4.73). In phase 9 the cattle butchery is located on the proximal and distal humerus, proximal radius and distal femur (Figure 4.76). For caprines, there are still chop marks on the distal half of the tibia but the majority is located on proximal femurs (Figure 4.77). The butchery on large and medium mammal vertebrae suggests that the animals were split into right and left halves by chopping through the vertebral

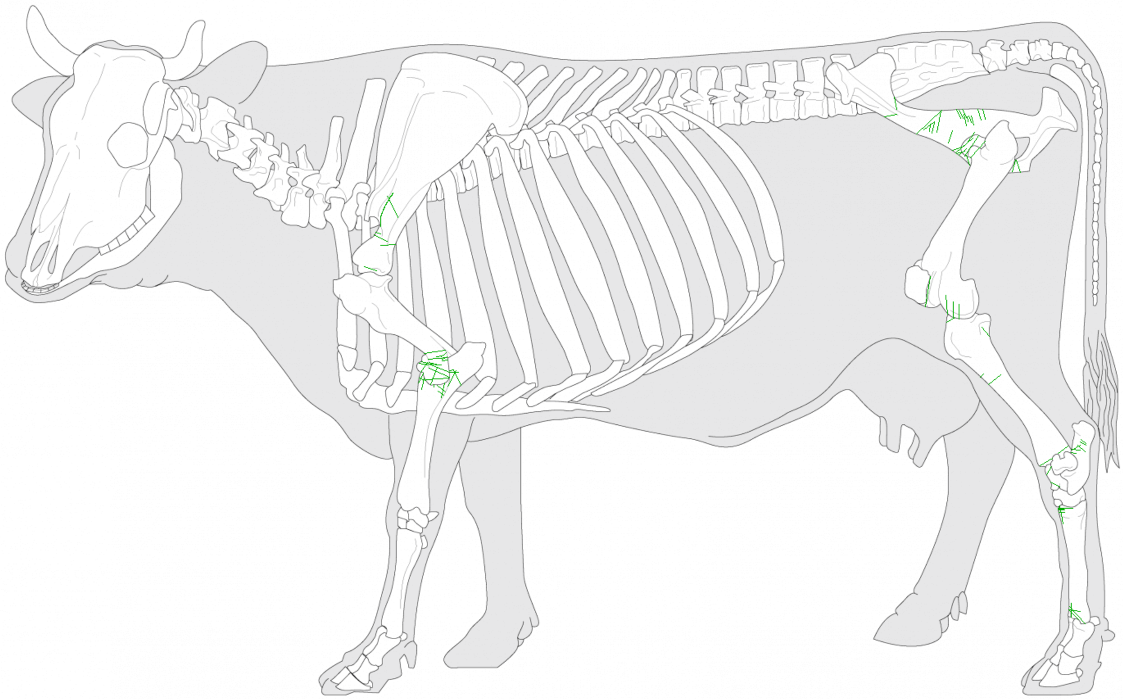


FIGURE 4.71: Cattle butchery from phase 7 at Queen Street. Key: green - chop

bodies (Figure 4.74 and 4.75). In large mammals the angle of the splitting is very consistent though there is more variation in the angle in medium mammals. As no marks have been recorded on the vertebral arch or spine, the splitting is likely to have happened from the anterior side of the spinal column i.e. the animals would have been gutted first and split later.

Aging - fusion: The relative proportions of stage 4 fused and unfused elements in cattle, caprines, and pigs show clear differences in the slaughter ages. Stage 4 is the final fusion stage, so the data presented in Figure 4.78, 4.79, and 4.80 show the proportion of animals that had fully fused skeletons against the ones that died before this stage. Only very few pigs survived to full skeletal maturity, indicating that they were all killed for meat (Figure 4.80). However, the trends for cattle and caprines change over time. In the Roman Civil period (phase 2) all animals from both species survive past stage 4, but in the first half of the Saxo-Norman period it drops to 50% for cattle, and 70% for caprines, indicating that secondary products such as milk and wool became a priority. For cattle this continued throughout the rest of the medieval phases, but for caprines the century after the Norman Conquest (phase 6) showed an increasingly large proportion of animals

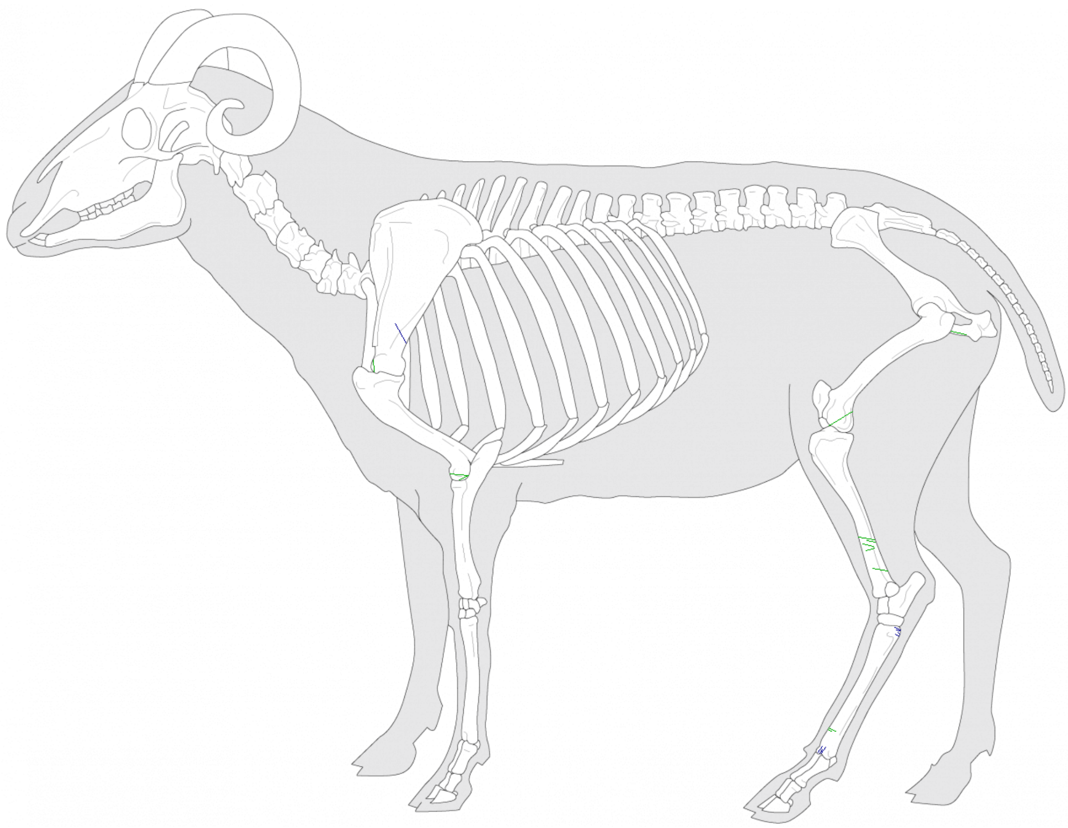


FIGURE 4.72: Caprine butchery from phase 7 at Queen Street. Key: green - chop

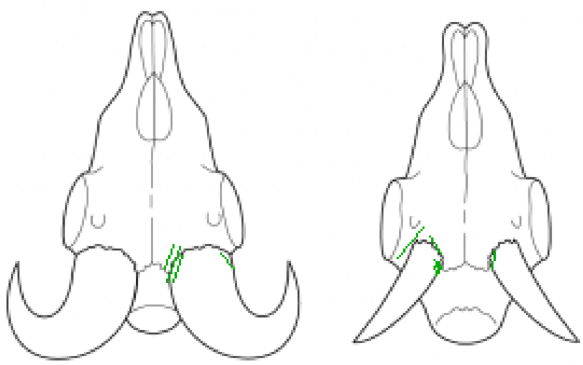


FIGURE 4.73: Caprine butchery from phase 7 at Queen Street. Key: green - chop

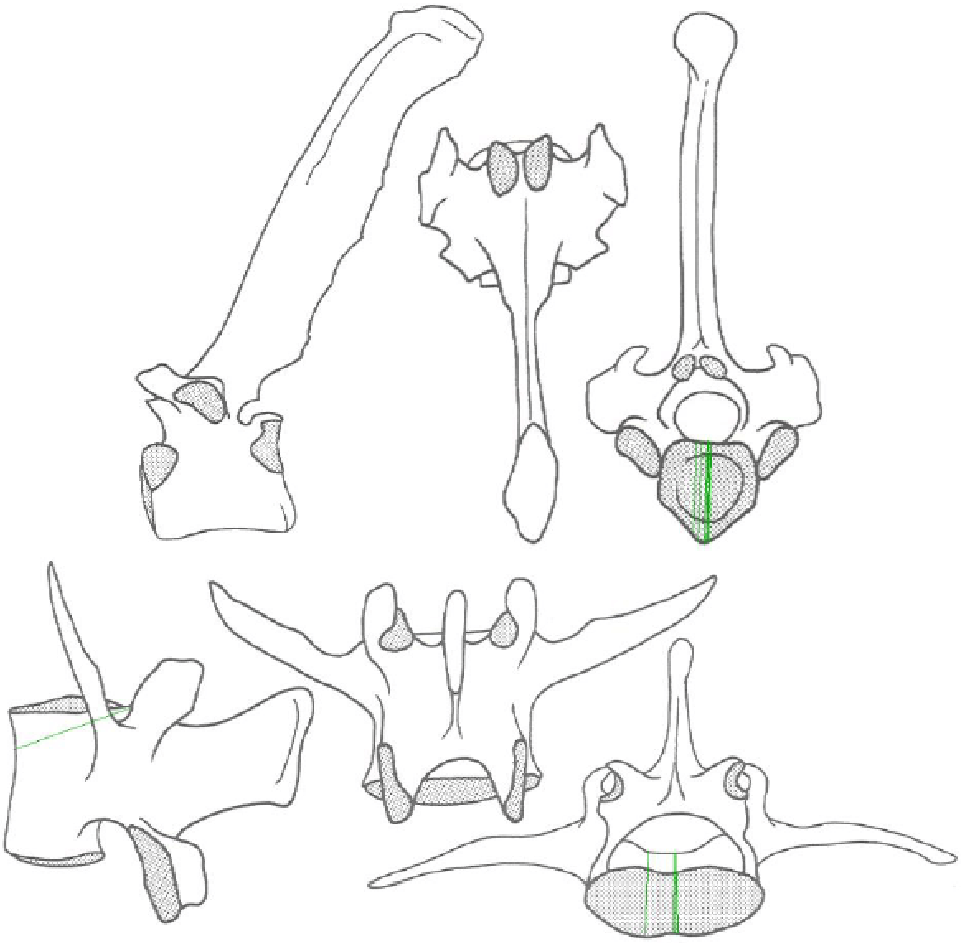


FIGURE 4.74: Large mammal butchery from phase 9 at Queen Street. Key: green - chop

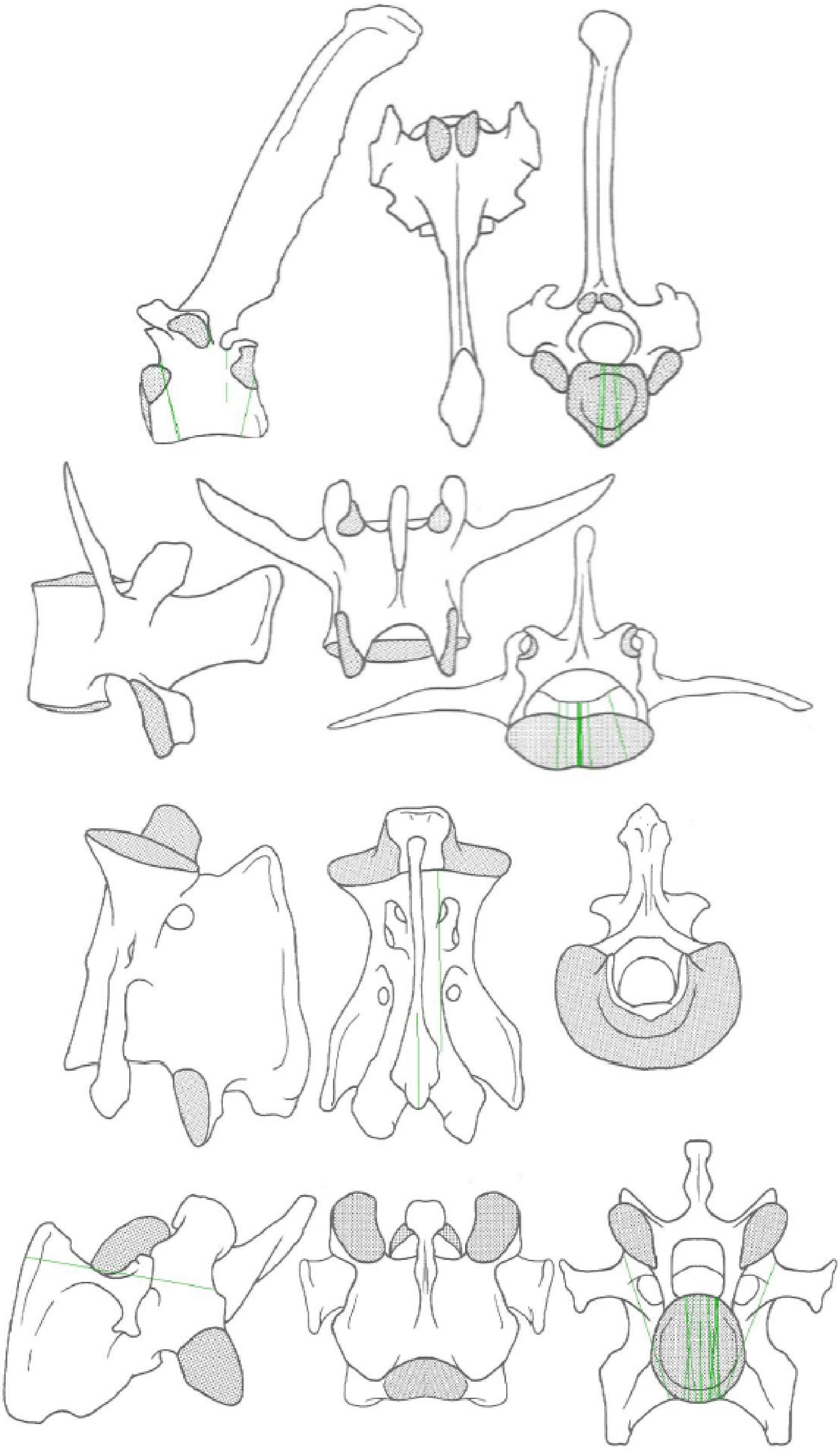


FIGURE 4.75: Medium mammal butchery from phase 9 at Queen Street.
Key: green - chop

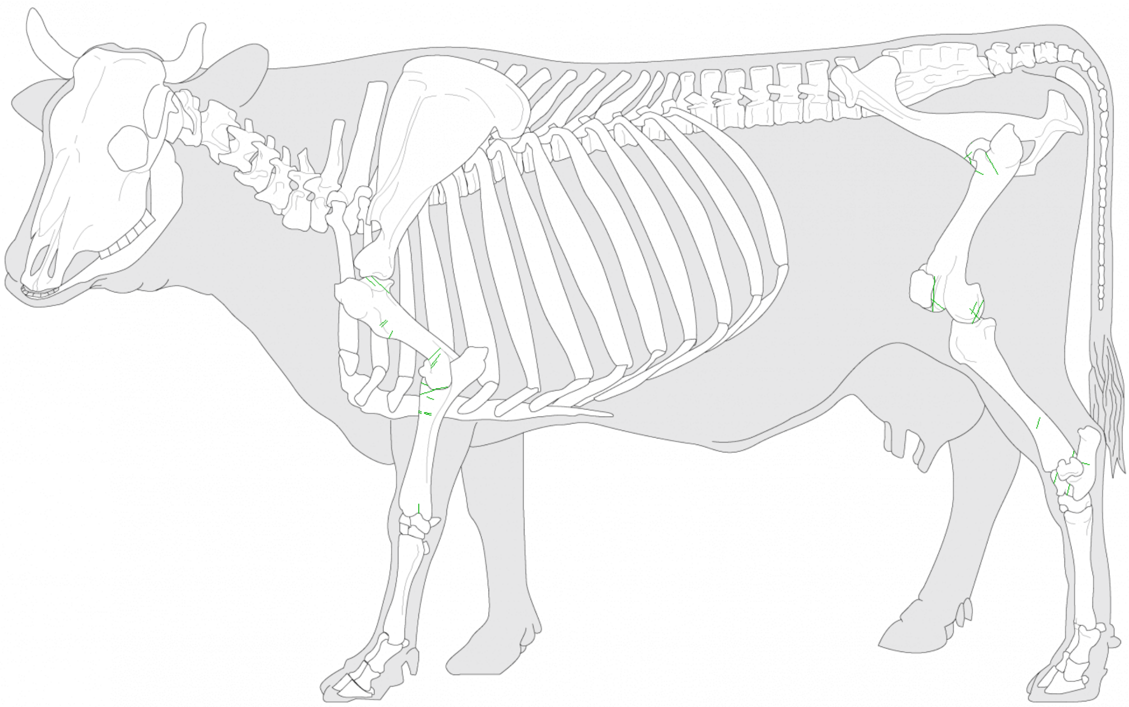


FIGURE 4.76: Cattle butchery from phase 9 at Queen Street. Key: green - chop

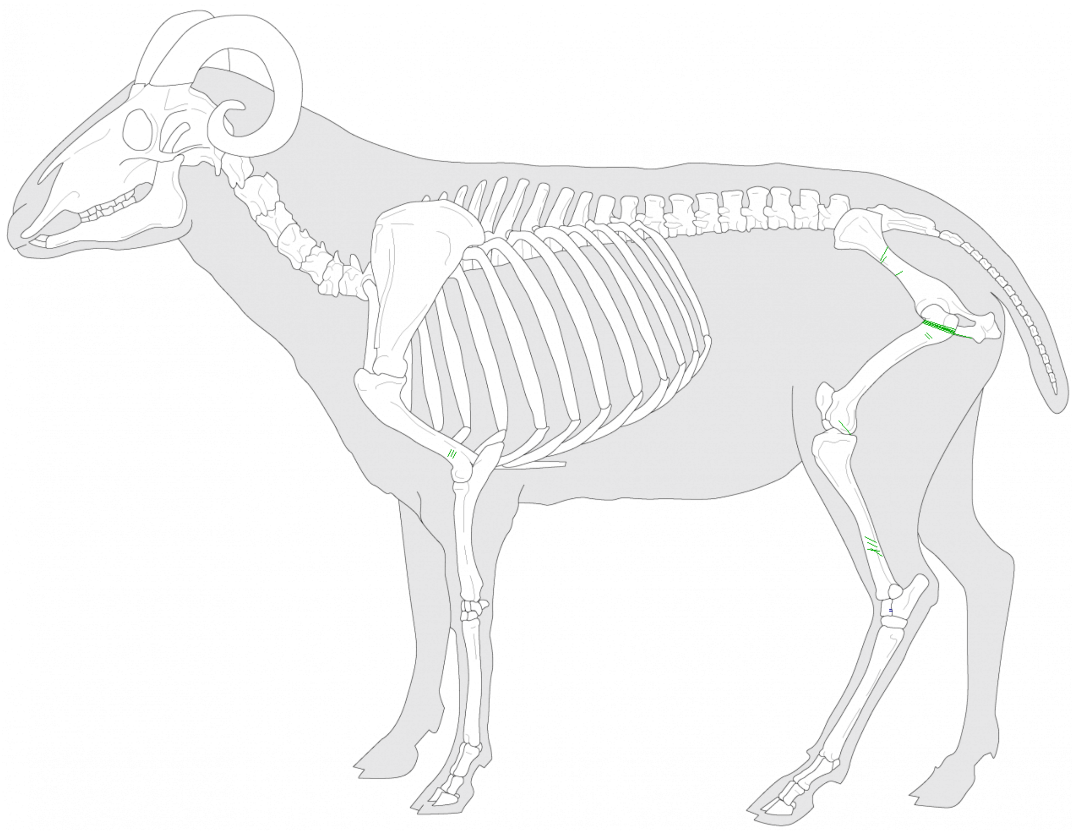


FIGURE 4.77: Caprine butchery from phase 9 at Queen Street. Key: green - chop

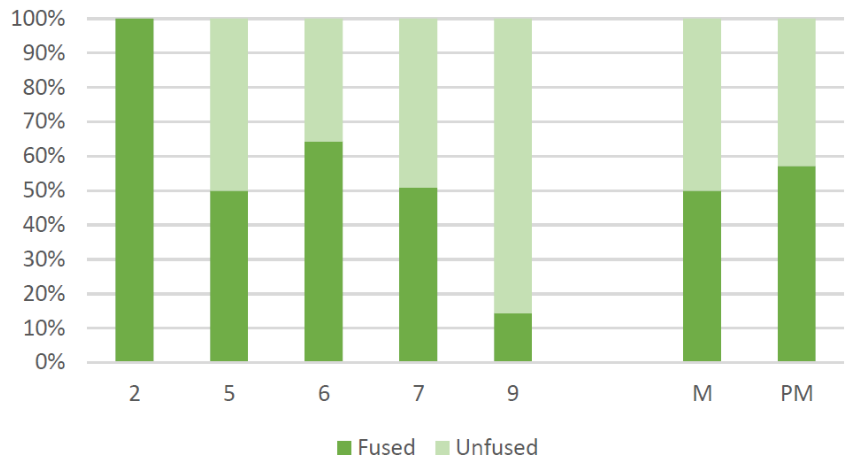


FIGURE 4.78: Stage 4 cattle fusion by phase from Queen Street

killed at a young age and by phase 7, almost all caprines appear to have been slaughtered before full skeletal maturity. By the first half of the post-medieval period (phase 9), caprines once again survive to older age, indicating that secondary products became the main priority, though for cattle the opposite pattern can be seen and 85% of all animals were killed before stage 4 fusion.

Aging - dental wear: Table 4.84, 4.85, and 4.86 present absolute counts for the number of mandibles of cattle, caprines, and pigs at each wear stage. The caprine mandibles from phase 7 suggest that most of the animals were killed at a relatively young age, 1-2 years, supporting the fusion data that also suggest they were reared for meat. There are not enough data available for the remaining species and phases to be presented here.

Sex: Table 4.87 presents the absolute counts for identified male and female cattle, caprines, and pigs. For the phases where data are present, males are typically more frequent than females, except for in pigs, though these trends may be heavily biased by the difficulties in identifying sex in faunal remains.

Metrics: Summaries of the measurements from cattle, caprines and pigs are presented in Table 4.88, 4.89, and 4.90. Phases with fewer than five measurements from a species have not been included here.

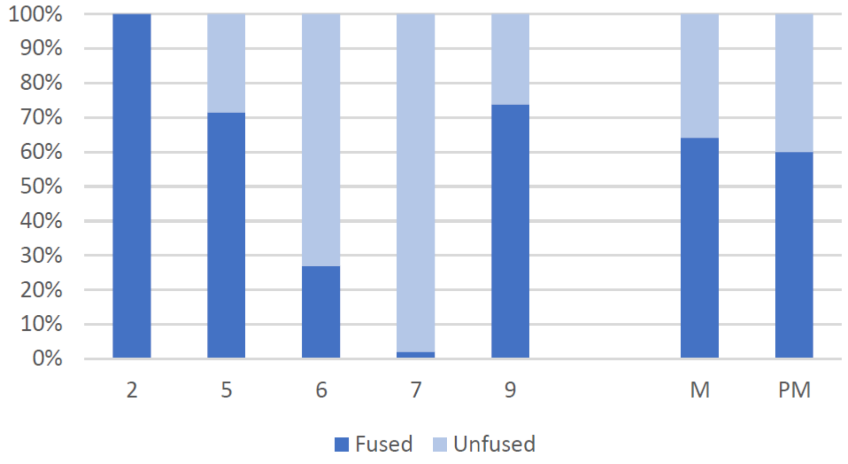


FIGURE 4.79: Stage 4 caprine fusion by phase from Queen Street

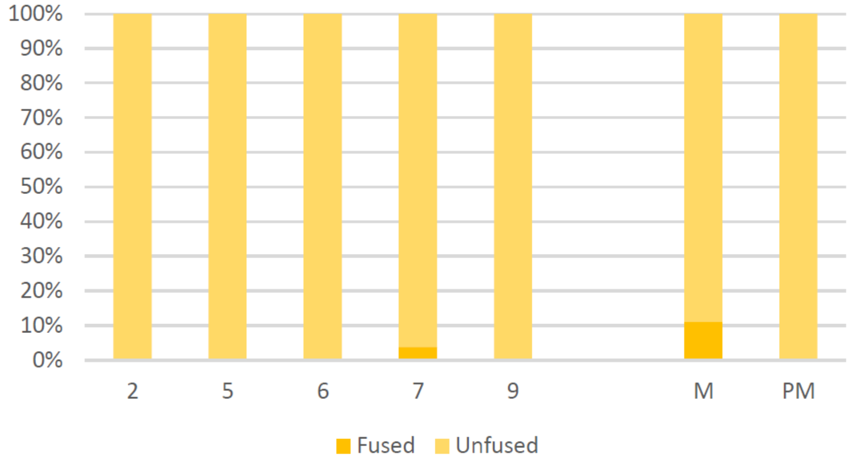


FIGURE 4.80: Stage 4 pig fusion by phase from Queen Street

TABLE 4.84: Cattle tooth wear by phase from Queen Street

Wear stage	2	5	6	7	9	M	PM
A	-	-	1	-	-	-	-
B	-	-	-	-	3	-	-
C	-	-	-	-	-	-	-
D	-	-	-	2	-	-	-
E	-	-	-	-	-	1	-
F	-	-	-	-	-	-	-
G	-	-	-	2	2	-	-
H	-	-	-	3	1	-	-
I	-	-	-	1	-	-	-

TABLE 4.85: Caprine tooth wear by phase from Queen Street

Wear stage	2	5	6	7	9	M	PM
A	-	-	-	-	-	-	-
B	-	-	-	1	2	-	-
C	-	-	-	-	-	-	-
D	1	-	2	9	-	-	-
E	1	1	1	3	-	-	-
F	-	-	-	4	-	-	-
G	-	-	2	1	-	-	-
H	-	-	1	1	1	-	1
I	-	-	-	-	-	-	-

TABLE 4.86: Pig tooth wear by phase from Queen Street

Wear stage	2	5	6	7	9	M	PM
A1	-	-	-	-	-	-	-
A2	-	-	-	-	1	-	-
A3	-	-	-	-	-	-	-
B	-	-	-	-	-	-	-
C	1	-	-	5	-	-	-
D	-	-	1	2	-	1	1
E	-	-	-	2	-	-	-
F	-	-	-	-	-	-	-
G	-	-	-	-	-	-	-

TABLE 4.87: Absolute counts of sex for major domesticates by phase from Queen Street

		2	5	6	7	9	M	PM
Cattle	Male	-	-	-	3	-	1	-
	Female	-	-	-	3	-	-	-
Caprines	Male	-	2	1	13	6	4	-
	Female	-	-	4	8	-	5	-
Pig	Male	1	-	1	3	-	-	-
	Female	1	1	2	2	1	-	-

TABLE 4.88: Summary of cattle measurements from Queen Street, with number of specimens, average, minimum and maximum measurements

Cattle		Phase 2				Phase 6				Phase 7				Phase 9				Phase M			
Element	Measurement	n	Average	Min.	Max.	n	Average	Min.	Max.	n	Average	Min.	Max.	n	Average	Min.	Max.	n	Average	Min.	Max.
Astragalus	GL1					3	56,47	54,19	58,85	3	59,38	54,56	63,4	1	68,31	68,31	68,31				
Femur	Bd																				
	Bp																				
	GL																				
	SD																				
Horncore	Greatest (o-a)	2	50,31	49,33	51,29	1	47,47	47,47	47,47	8	48,37	40,4	55,45	2	53,99	51,75	56,22	2	37,51	36,57	38,45
	Least (d-b)	2	34,43	32,93	35,93	1	36,16	36,16	36,16	8	38,01	32,34	44,75	2	42,41	38,58	46,23	2	29,19	28,25	30,13
Humerus	Bd													1	85,59	85,59	85,59	1	77,75	77,75	77,75
	Bp																				
	GL																				
	SD																				
Metacarpal	Bd	1	49,62	49,62	49,62	1	49,89	49,89	49,89	3	52,98	49,33	59,06								
	Dd					1	25,65	25,65	25,65	2	26,93	26,46	27,4								
	Bp	1	53,4	53,4	53,4	2	47,36	46,37	48,34	7	51,48	46,36	56,84	1	46,72	46,72	46,72	1	53,11	53,11	53,11
	GL	1	180	180	180	1	176	176	176	2	179,5	176	183								
	SD	1	25,59	25,59	25,59	1	25,72	25,72	25,72	3	27,28	25,62	28,64								
Metatarsal	Bd					3	50,89	44,48	58,98	1	44,01	44,01	44,01								
	Dd					3	27,35	24,57	30,3	1	25,89	25,89	25,89								
	Bp					4	45,65	40,78	48,9	2	40,72	37,98	43,46	3	45,81	38,93	52,73				
	GL					3	199,17	181,5	219												
	SD					3	25,59	22,61	28,24												
M3	Length									3	33,48	31,14	37,4	2	33,32	31,18	35,46	2	31,85	31,19	32,5
Radius	Bd					1	54,8	54,8	54,8	2	56,57	55,93	57,21								
	Bp					1	64,24	64,24	64,24	9	70,86	66,48	75,25	3	84,8	84,07	85,53	2	72,68	68,67	76,68
	GL																				
	SD																				
Scapula	GLP	3	55,2	53,51	57,16	2	56,75	54,39	59,11					2	75,14	68,88	81,4				
Tibia	Bd					2	55,13	51,08	59,17	3	57,49	56,54	58,97	1	69,29	69,29	69,29	1	53,89	53,89	53,89
	Bp									1	93,8	93,8	93,8								
	GL																				
	SD																				

TABLE 4.89: Summary of caprine measurements from Queen Street, with number of specimens, average, minimum and maximum measurements

Caprines		Phase 6				Phase 7				Phase 9				Phase M				Phase PM			
Element	Measurement	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	*n*	Average	Min.	Max.	n	Average	Min.	Max.
Astragalus	GL1									4	27,73	26,03	28,97								
Femur	Bd									1	35,06	35,06	35,06								
	Bp																				
	GL																				
	SD																				
Horncore	Greatest (o-a)					7	41,21	28,74	49,79					5	27,61	23,77	33,21				
	Least (d-b)					7	28,44	17,29	34,78					5	18,82	16,05	22,07				
Humerus	Bd	*1*	28,44	28,44	28,44	6	27,38	26,01	30,58	12	28,98	26,8	30,82	2	29,41	28,18	30,64	1	28,8	28,8	28,8
	Bp									1	37,3	37,3	37,3								
	GL																				
	SD																				
Metacarpal	Bd					2	22,52	21,62	23,42	1	21,04	21,04	21,04								
	Dd					2	14,83	14,17	15,48												
	Bp	*2*	20,3	19,6	21	4	20,8	19,8	22,23												
	GL					1	104,91	104,91	104,91												
	SD					1	12,55	12,55	12,55												
Metatarsal	Bd	*1*	18,98	18,98	18,98	4	21,19	20,4	22,83												
	Dd					4	14,41	13,54	16												
	Bp					5	18,16	16,91	19,33									1	18,33	18,33	18,33
	GL					3	122,97	110,2	131,37												
	SD					3	10,09	9,62	10,86												
M3	Length	*2*	20,99	20,63	21,35																
Radius	Bd	*1*	25,53	25,53	25,53	1	26,83	26,83	26,83	7	26,52	25,38	27,71	1	25,56	25,56	25,56	1	27,27	27,27	27,27
	Bp	*3*	28,38	27,5	29,76	9	28,47	27,34	30,26	15	30,03	27,64	33,48	2		28,88	29,94	3	28,69	26,3	31,46
	GL									7	139,19	124,88	157					1	145,61	145,61	145,61
	SD									7	15,63	13,9	17,6					1	16,56	16,56	16,56
Scapula	GLP	*2*	28,47	26,34	30,6	3	29,7	28,5	30,54	6	31,37	29,26	33,1	1	29,55	29,55	29,55	3	29,49	28,41	30,47
Tibia	Bd					7	23,8	22,78	25,69	4	25,05	24,24	26,36	6	23,85	22,44	26,19	3	25,66	24,83	26,14
	Bp									2	38,89	38,13	39,64								
	GL									1	187,5	187,5	187,5								
	SD									1	13,6	13,6	13,6								

TABLE 4.90: Summary of pig measurements from Queen Street, with number of specimens, average, minimum and maximum measurements

Pig		Phase 7			
Element	Measurement	*n*	Average	Min.	Max.
Astragalus	GLl				
Femur	Bd				
	Bp				
	GL				
	SD				
Horncore	Greatest (o-a)				
	Least (d-b)				
Humerus	Bd				
	Bp				
	GL				
	SD				
Metacarpal	Bd				
	Dd				
	Bp				
	GL				
	SD				
Metatarsal	Bd				
	Dd				
	Bp				
	GL				
	SD				
M3	Length				
Radius	Bd				
	Bp	*5*	26,38	25,34	27,96
	GL				
	SD				
Scapula	GLP	*1*	34,38	34,38	34,38
Tibia	Bd	*1*	29,32	29,32	29,32
	Bp				
	GL				
	SD				

Chapter 5

Carcass Division

5.1 Introduction

This chapter will focus on how cattle, caprines, and pigs were butchered and distributed throughout Exeter. As mentioned in Chapter 4, the data discussed from this point onwards will be assigned to groups to aid our understanding of the variations between contemporary areas of the settlement and how they develop over time.

The distribution and consumption of meat, and indeed other foodstuffs, has great symbolism, and is imbued with social meaning (Ervynck 2004; Fiddes 1991; Pluskowski 2007; Shuman 1981; Symons 2002). Meat itself has meaning, the way the carcass is divided can be highly symbolic, and animal species can have both symbolism and status. Butchery can tell us about food, but also about the use of bones and other primary products in industries such as horn working, tool production, leatherworking and so forth. The way in which a carcass is divided into smaller pieces is often specific to species and time period, but can sometimes be unique to a geographical area, settlement type, or even town. In reality, it is very difficult to interpret butchery data and skeletal part abundances as the level of detail in the interpretation is entirely dependent on the amount of data and the way they are processed. In an ideal world, all bones would be perfectly preserved with clearly visible butchery marks and come from large, closely dated contexts with known association such as a particular household or profession. Unfortunately, such cases are very rare and if all contexts have to be assessed individually, it would be a very time-consuming task, and most contexts do not have enough material to warrant such detailed analysis as only a small proportion of the identifiable specimens have butchery evidence on them. Unless the intention is to chop through the bone, cutmarks may only occur when the butcher presses too hard, as any contact with the bones will blunt the knife or other bladed tool. Though all is not lost. Material can be grouped together, and while finer details are lost, broader trends become more visible and comparison between contemporary material is easier. Furthermore, considering different types of data at the same time can add depth to interpretations, which is why both butchery marks and skeletal part abundances are included here as all identifiable specimens contribute towards the skeletal part abundances which can bridge the gaps where butchery data are missing and add information on how the butchered carcasses were distributed.

In this study, particular attention has been paid to the practice of dividing carcasses into halves as it can tell us about the development of professional butchers and thereby social organisation. A variety of terms have been used to describe this method such as splitting, midline splitting, dorsal-ventral splitting, longitudinal splitting, and halving. They all describe the same thing though 'dorsal-ventral' splitting should not be used. This term is highly misleading as it could mean that the vertebral spine is parted by taking off the ventral arch and spinous process. What is really meant is to divide the carcass from the dorsal side to the ventral side, though this is once again misleading as it indicates a presumed direction of the action. In this thesis the term 'sagittal splitting' will be used instead as it describes the plane on which the carcass is split but without the suggestion of a direction. This plane may also be referred to as midsagittal, median, or midline, though these are rarely used in this context. Further discussions of the relevance of sagittal splitting are available in the sections below.

5.2 Roman

Table 5.1, 5.2, and 5.3 show the types and proportions of butchery identified in the three Roman phases. The Roman Civil phase (phase 2) appears to have a wider range of species and a much higher number of cases of butchery compared to the Roman military (phase 1), the end of the Roman occupation, and the following few centuries (phase 3), though this is primarily due to the varying numbers of NISP for each phase. Phase 3 in particular,

TABLE 5.1: Phase 1 butchery types, amount, and proportion of species NISP

Species	Type	Number	Proportion
Cattle	Chop	7	5.3%
Caprine	Chop, cut	5	6.5%
Pig	Chop, cut	5	5.7%
Red deer	Chop, cut, saw	4	28.6%
Horse	Saw	1	9.1%
Medium mammal	Chop, cut	2	10.5%
Large mammal	Chop	1	5%

is heavily influenced by its total NISP of 150. Therefore, only general interpretations can be drawn from the data from this phase, and it may not be representative of the whole phase.

All three types of tool marks have been identified in phase 1 and 2, though saw marks only appear to occur with red deer and horse. Elsewhere, the presence of saw marks has been associated with craft activities rather than primary butchery (MacGregor 1985). In both military and civil Roman Exeter saw the marks are located on horse metapodia and red deer antler, which supports the association with craft activities as these elements were frequently used for tool making (MacGregor 1985; 1991). For the main livestock species, only cattle see a noticeable shift in proportions of butchered specimens, with approximately 10% more recorded cases in phase 2 compared to both phase 1 and 3. As there is a similar shift for large mammal vertebra and rib specimens, the majority of which are likely cattle, this suggests that cattle carcasses were more frequently displaying butchery marks during the Roman Civil phase indicating that the priority of the butcher was to roughly divide cattle into smaller portions by chopping rather than choosing the more time consuming method of using more delicate implements and avoiding striking the bones.

As a general Roman trend, locations of butchery marks on cattle are consistent. Chop marks tend to occur alone or in pairs if a mistake was made in the first instance, and cut marks occur in clusters of several marks that were part of the same butchery event. Looking at the distribution of chop marks on phase 1 cattle specimens (Figure 5.1), they are almost all located around joints and on the proximal end and spine of the scapula. On the front leg most are located above or below the joint whereas on the hind leg they are

TABLE 5.2: Phase 2 butchery types, amount, and proportion of species NISP

Species	Type	Number	Proportion
Cattle	Chop, cut	86	15.5%
Caprine	Chop, cut	8	4.5%
Pig	Chop, cut	11	7.5%
Sheep	Cut	1	10%
Goat	Cut	1	50%
Red deer	Chop, cut	3	33.3%
Horse	Saw	2	6.7%
Medium mammal	Chop, cut	4	5.8%
Large mammal	Chop, cut	6	13.3%
Domestic fowl	Cut	1	4%
Goose	Cut	1	100%

TABLE 5.3: Phase 3 butchery types, amount, and proportion of species NISP

Species	Type	Number	Proportion
Cattle	Chop, cut	3	4.9%

focussed on the joint itself. Phase 2 cattle butchery is still located around the joints and the larger amount of recorded cases show some possible trends (Figure 5.2, 5.3, and 5.4). 31 of the 86 specimens with butchery marks are located on the proximal end and spine of the scapula indicating that this is the most frequently butchered element. The locations of the chops are consistent with trimming of the shoulder blade in association with smoking or brining (Dobney et al. 1995, 26; Lauwerier 1988; Maltby 2014). The trimming may have been observed by Maltby in his analysis of Exeter faunal material as he notes in his description of cattle butchery that the scapula was frequently 'broken' where the spine begins (Maltby 1979, 39). On other sites where butchery has been recorded in detail, such as in Lincoln, Ilchester, and York, similar evidence for preserving of the shoulder has also been observed (Dobney et al. 1995, 26; Levitan 1994, Figure 64; O'Connor 1988, 82-83).

In phase 2, similar to phase 1, the fore and hind limbs are butchered differently. In terms of type, chops are more frequently observed on the fore limb, whereas cuts are more frequent on the hind limbs. In general, the cuts on both limbs are located around joints suggesting at least sometimes, cattle would be disarticulated with a knife, though the cuts on distal metapodia suggest that some animals were skinned. Further evidence of leather working is present as chop marks around the horncores, though this could also be a sign of horncore processing. Apart from the on scapula, the remaining chops on the fore limb are all focussed on the humerus-radius-ulna joint suggesting the meaty humerus was a frequently used portion. There is no evidence for the front limb below the humerus being divided, so this part may have been one large portion.

Comparative to the fore limb, there is little evidence for how the hind limb was divided. The location of cuts around the pelvis-femur and metatarsal-tarsal joints indicate that some hind limbs were divided through the joints, though the location of chop marks on the proximal shaft of the tibia, distal shaft of the femur, metatarsal shaft, and ilium of the pelvis indicate a very different butchery method. This suggests there were three possible ways of dividing a cattle carcass: 1) by using a knife around the joints, 2) by chopping through shafts and preserving articulated joints, or 3) a combination of 1) and 2) where the hind limb is first divided into joints of meat by method 2) and then divided into smaller portions using method 1). Unfortunately, there is not enough evidence from the end of the Roman occupation and following thereafter (phase 3), to determine if there is continuity or change from phase 2 to 3. The locations of butchery marks in pigs have some similarities to cattle (Figure 5.5). The chop marks are almost all on the proximal scapula and distal humerus, however, the ones on scapulae appear to be a result of removing the glenoid cavity and neck from the blade rather than to trim as seen in cattle.

Cut marks are present as well, though none are likely to be a result of disarticulation but rather removal of specific cuts of meat. Particularly the ones on mandibles are possible signs of removal of the tongue if the marks are on the medial aspect of the ramus, or if the marks are on the lateral aspect they may associated with removal of the cheek meat. Additionally, there is a single case where the frontal of the cranium had been split into two halves by a chop to the metopic suture. This may have been done to gain access to the brain and/or to divide the cranium into smaller pieces for easier cooking.

A note should be made of two additional phase 2 cases observed on vertebrae. The two specimens (probable cattle and sheep) were sagittally split in a posterior-anterior direction from the ventral to the dorsal side with a heavy blade, likely a cleaver. In other words, the carcass has been gutted, hung by its hind legs and then split from tail-end to neck into left and right halves. This type of butchery becomes very common in later

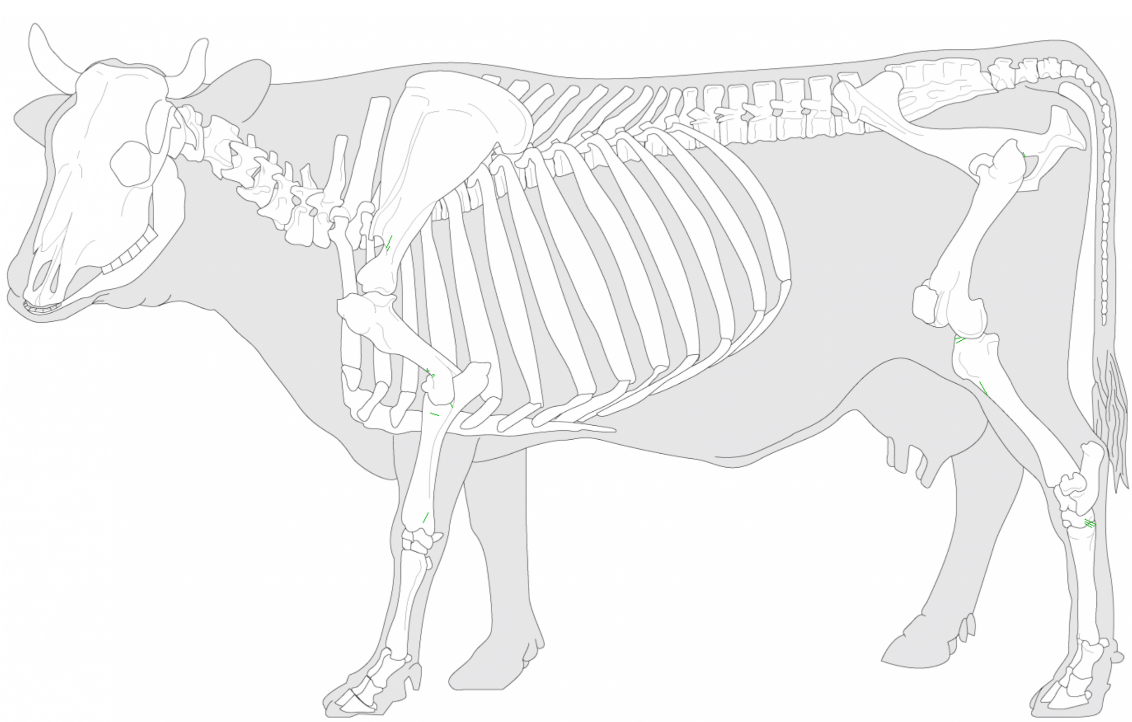


FIGURE 5.1: Cattle butchery from phase 1. Key: green - chop, blue - cut

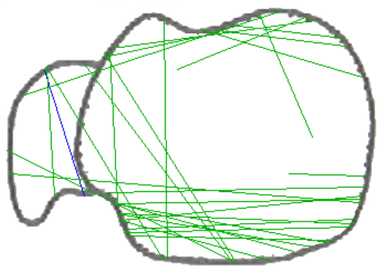


FIGURE 5.2: Cattle proximal scapula butchery from phase 2. Key: green - chop, blue - cut

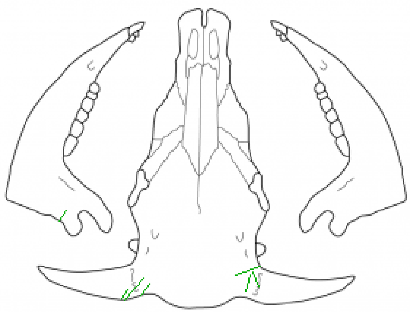


FIGURE 5.3: Cattle cranial butchery from phase 2. Key: green - chop

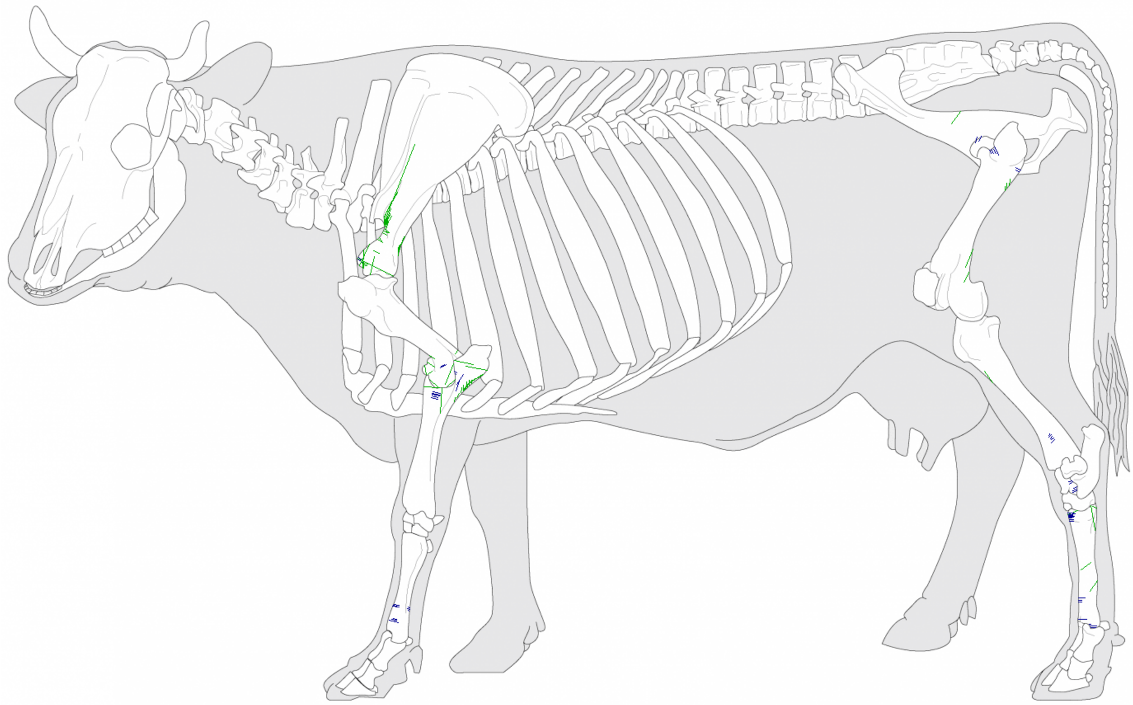


FIGURE 5.4: Cattle butchery from phase 2. Key: green - chop, blue - cut

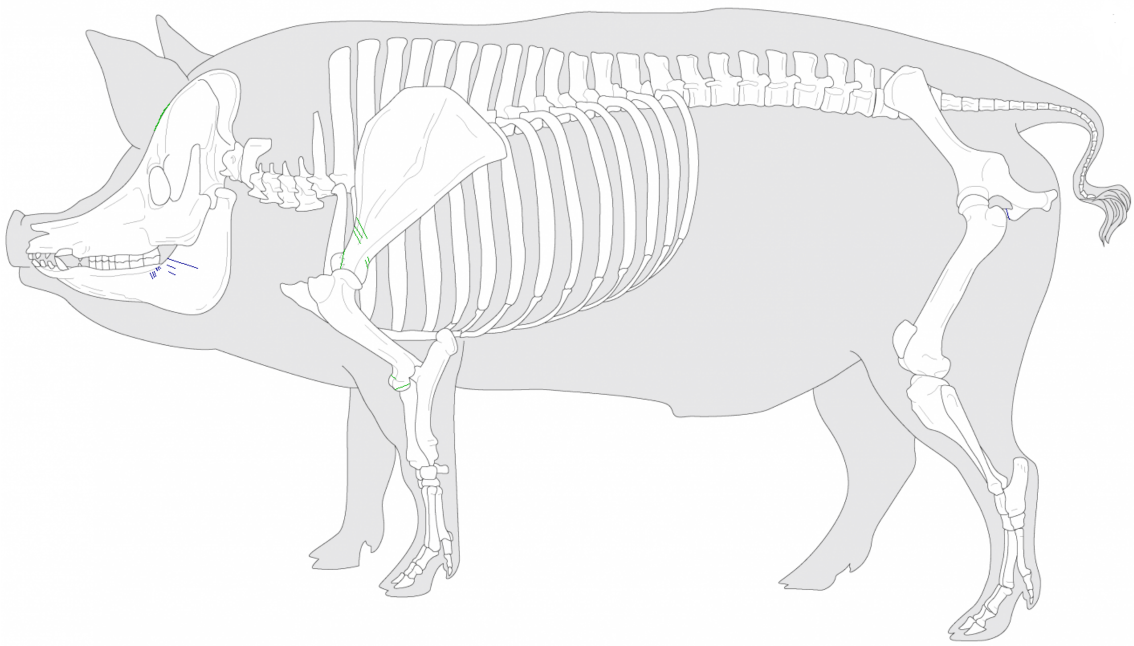


FIGURE 5.5: Pig butchery from phase 2. Key: green - chop, blue - cut

periods, notably the post-medieval period, but only a small number of cases have been recorded in England so far, Winchester being one of the only places where it has been noted, though it has been recorded in Italy (MacKinnon 2004; Maltby 1989) suggesting that it may be more common in the heart of the Roman Empire than on the outskirts. Sagittal splitting is closely associated with professional butchers as it requires specialist equipment and vertical space high enough to lift a whole carcass off the ground, so combined with the consistency of the other chop and cut marks, there were undoubtedly professional butchers, likely with designated buildings for their use, present in Roman Exeter (Rixson 2000; Seetah 2006).

The skeletal part abundances provide further insight into carcass processing, particularly in phases and for species where there is minimal butchery evidence. For species where we do have both skeletal part abundances and butchery records, such as cattle in phase 1 and 2, the combination of the two types of evidence builds a more detailed image of the nature of the faunal refuse. The higher proportions of cattle metapodia and mandibles in phase 1 suggest that the majority of the recovered specimens are from primary butchery deposits rather than household waste (Figure 5.6). Moving into phase 2, metapodia and mandibles are still frequent, though the proportion of humeri and in particular scapulae have increased, suggests the refuse now represents both household and primary butchery waste. These variations in element proportions provide explanation for the shifts in observed cattle butchery patterns between phase 1 and 2. The lack of recorded butchery on scapulae and humeri from phase 1 is likely due to the small number and proportions of these elements rather than a lack of butchery in this phase. Comparatively, metapodia and mandibles have small numbers of recorded butchery cases in both phase 1 and 2 in spite of the elements being very frequent, which suggests the lower legs were removed using a technique that rarely left visible marks on the bones. As cut marks are the most frequent on metapodia, the removal of lower legs may have been done using a knife, so the lack of marks is not surprising, as it is in a butcher's best interest to avoid hitting the bone when using a knife as it dulls the blade. In both phases, the lack of butchery on femora and tibia appears to be a result of low frequencies of these elements. It is unknown why these elements do not occur along with the other high meat utility elements as it is clear from the skeletal part abundances that whole animals are brought into the settlement. One possible explanation may be that these elements are utilised differently such as for marrow extraction, which would leave the elements in smaller pieces that are harder to identify to species level. This possibility will be discussed further in chapter 6.

Moving to the end and after the Roman occupation (phase 3), there is a clear shift in what parts of the cattle carcass are represented. Metapodia are still among the most frequent, but tibiae are equally as frequent while no femora have been identified and humeri and scapulae are only present in very low proportions. Not a great deal of meat is available from the tibiae, though it still appears that the nutritional value of this element was fully exploited, as indicated by the much lower representation of shafts comparative to epiphyses which suggests that the shafts were fractured for marrow leaving only the epiphyses in the archaeological record. There are no indications as to why there is a shift from scapulae and humeri to tibiae, though it may represent an increasing poverty in the population after the decline of the Roman Empire with the high meat yield elements ending up elsewhere. The trend could also be a result of the small sample size, as only a total of 151 specimens (cattle MAU = 31.5) were recovered from this phase; however, they are from sites in the North, South and West Quarters which suggests that the sample is representative of the majority of the population. The high numbers of metapodia and mandibles as well as the organised butchery observed throughout the Roman phases were also noted by Maltby, though no further detail was given on the relative proportions of the various elements (Maltby 1979, 39-40). Similarly, large numbers of mandibles were found in late 4th century material in Lincoln (Dobney et al. 1995, 30), suggesting that dumping of butchery waste may have occurred thoughout Roman Britain.

There are too few recorded cases of caprine butchery to draw any interpretations from, however, the skeletal part abundances suggest some variation in exploitation comparative to cattle (Figure 5.7). In the first and third Roman phases, elements from the front quarters of the animals occur in higher frequencies, in particular humeri and radii, than those from the hind quarters. In phase 2, the pattern is much more similar to that of cattle, with metatarsals and mandibles being the most frequent though tibiae are also present in high numbers. Overall, the patterns suggest that a mix of household and butchery waste has been recovered. These slight differences between the skeletal part abundances of cattle and caprines, suggest that the animals are treated similarly throughout the Roman period apart from clear preference for shoulders of beef in phase 2 and for caprine humeri in phase 3.

The phase 3 pig skeletal part abundances also show a preference for humeri (Figure 5.8), while in phase 1 scapulae and radii are represented in the greatest numbers. The abundances for phase 2 are almost identical to that of caprines with minimal differences in frequencies between the various elements, only mandibles stand out as being particularly abundant. It should be noted that the phase 3 MAU for pig is 12, so the frequencies may not be representative of the overall patterns for the phase. Pig butchery is also different from cattle. Rather than trimming the glenoid cavity and removing the scapular spine, the chops on pigs are placed across the neck of the scapula, likely leaving the proximal end of the scapula attached to the humerus. Cutmarks have been recorded on the mandible suggesting that the tongue may have been removed. The minimal variations in element representation suggest that pigs were consumed in a similar manner to the other livestock species, but the variation in butchery suggest they were processed differently. There are no clear indications as to why the species were treated differently, though, as there is no obvious distinction between high and low utility elements from pig, it may be that pigs were not divided into smaller portions thereby causing these elements to be recovered in fairly equal numbers.

It is unclear whether the same butchery patterns and skeletal part abundances were observed by Maltby as his descriptions are not always divided by time period, although as mentioned above, some comparisons can be made. In particular, he notes that sagittal splitting in either of the livestock vertebrae is uncommon prior to the post-medieval period. The lack of further evidence to support the two new cases suggests that sagittal splitting in the Roman period is a rare occurrence so the technique may not have been in use for very long. While the low frequencies of pig metapodia and phalanges presented in Figure 5.8 can partly be explained by recovery biases, another explanation is apparent through Maltby's analysis as he observed concentrations of pigs' trotters; these were

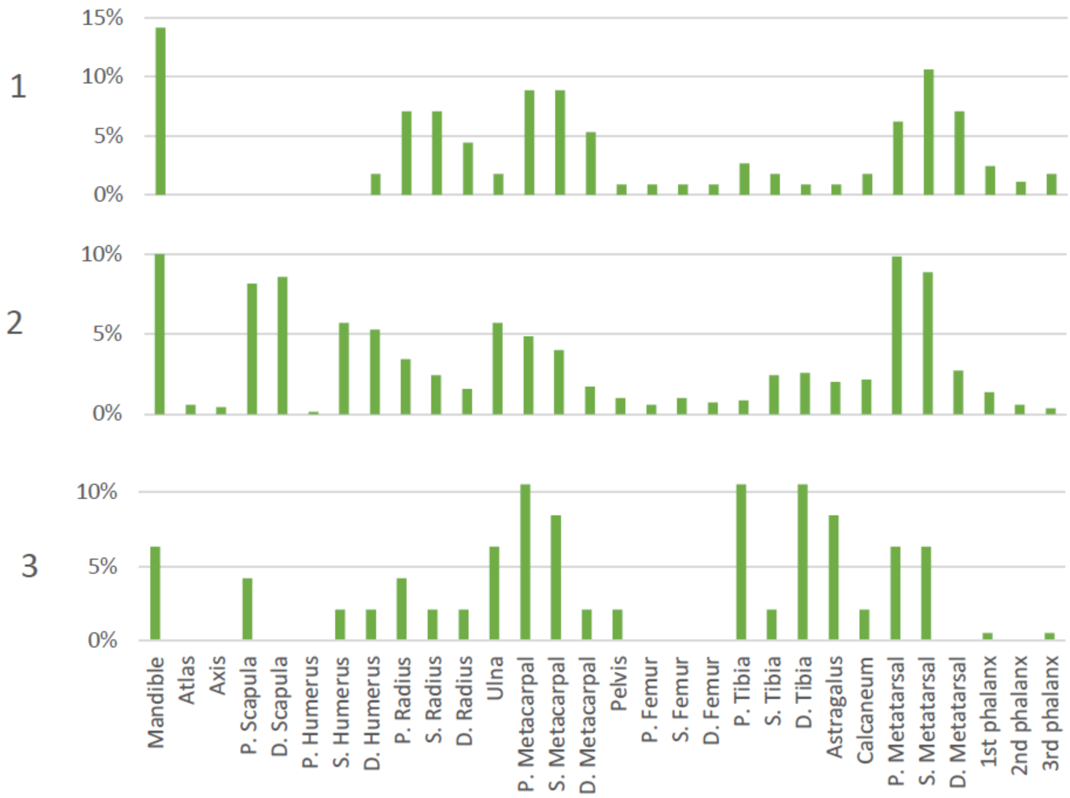


FIGURE 5.6: Cattle skeletal part abundances by phase.

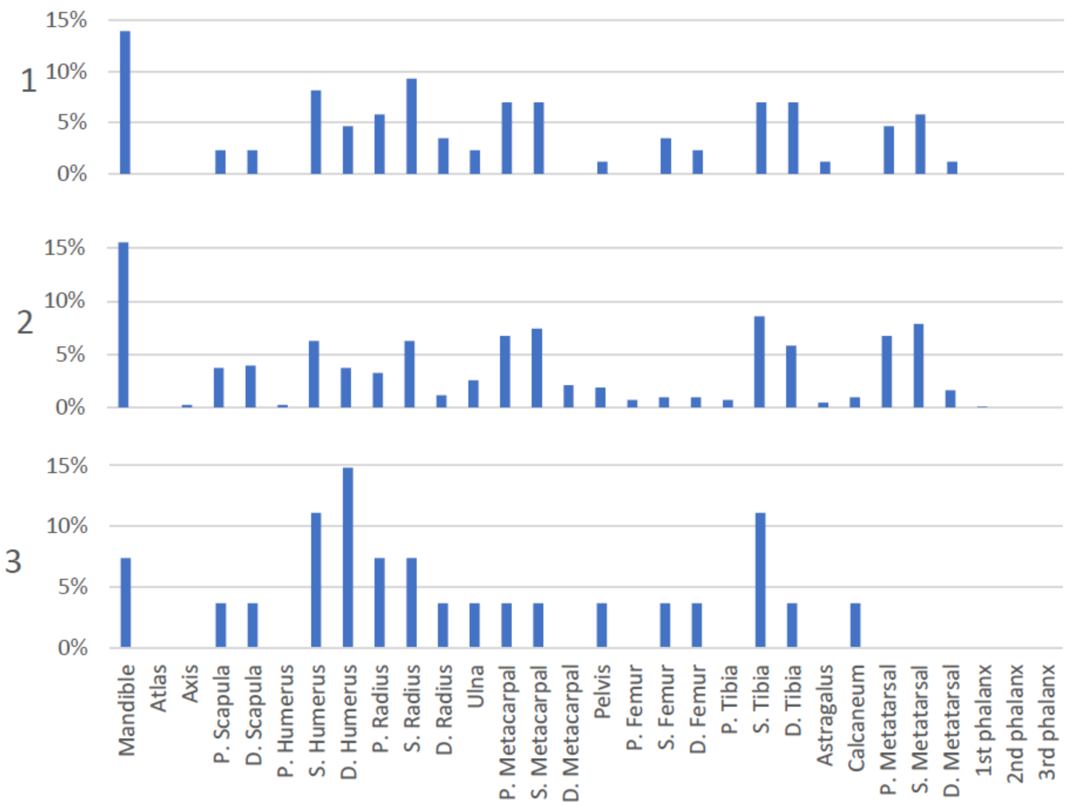


FIGURE 5.7: Caprine skeletal part abundances by phase.

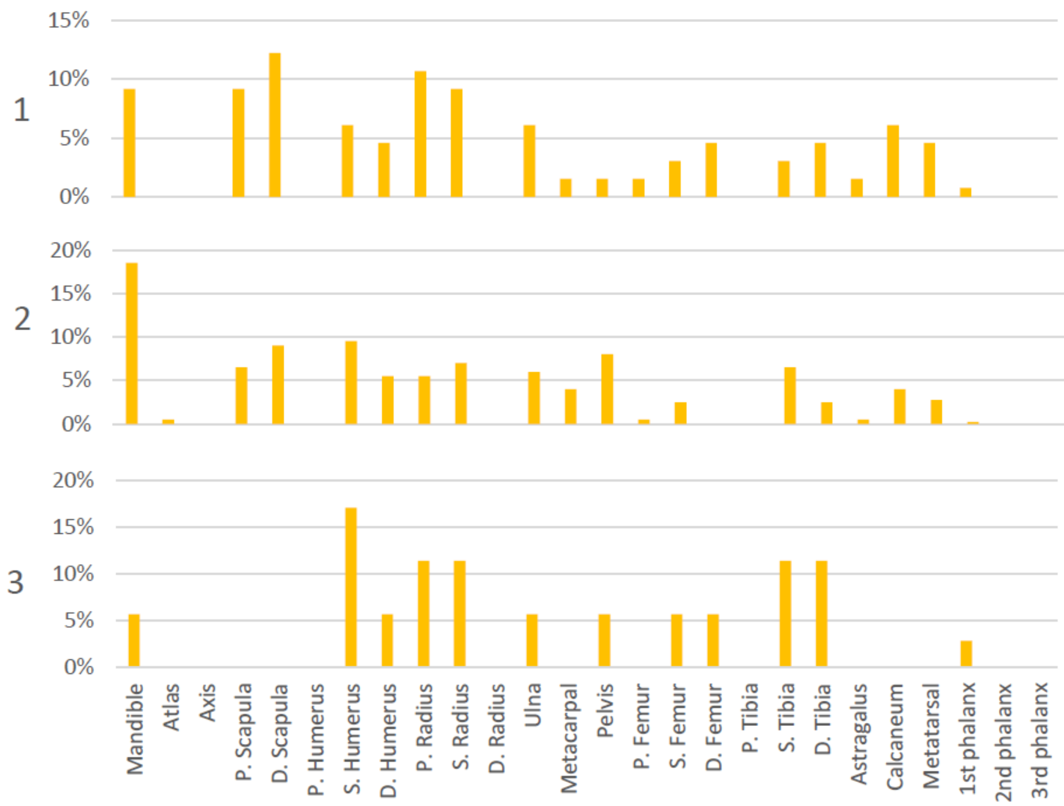


FIGURE 5.8: Pig skeletal part abundances by phase.

particularly frequent in the third century AD (equivalent to phase 2) (Maltby 1979, 59). The $3^{rd}/4^{th}$ century cattle skeletal representation from Lincoln is similar to Roman Exeter in terms of the identification of distinct concentrations of either primary butchery waste or household waste (Dobney et al. 1995, 24). There are further similarities in the poor representation of femora and tibiae. Concentrations of caprine primary butchery waste was also identified, though none containing household waste have been recorded. Similarly, mandibles are the are the most frequently occurring elements from pig (Dobney et al. 1995, 24). Low frequencies of cattle femurs and tibiae coupled with high frequencies of metapodia have been found in both Bath and Wroxeter, and in Bath high frequencies of pig mandibles are seen as well (Barber 1999, Fig 1.86, Fig 1.87, Fig 1.88; Hammon 2011, Fig. 4).

To summarise, in Roman Exeter there was some variation in carcass exploitation between phase 1, 2, and 3, with the most obvious shift occurring between the Roman Civil phase, phase 2, and the end of the Roman occupation and the following few centuries, phase 3, suggesting that the exploitation patterns seen in the Roman military and civil phases were linked specifically to a Romanised lifestyle rather than a local Devonian one. Observations of similar butchery techniques and skeletal part abundances in urban sites geographically distant from each other, indicate that this was a general trend in at least some of the Roman towns in England. Furthermore, the particular type of butchery signifies a certain mindset prioritising speed over finesse which was likely a necessity due to the large number of the military occupants and the increasingly growing population in the civilian town all of would have needed a daily meat supply. The noticeable discrepancy in the ratio of chop to cut marks, with chop marks being much greater in numbers could be due to the difficulty in identifying fine, shallow marks on weathered bone, though it is more likely to be a result of the butchery techniques employed by urban butchers.

In Maltby's review of urban and rural variations in cattle butchery in Hampshire, he notes that urban butchery was primarily done with heavy bladed implements, such as cleavers, whereas knives were commonly used on rural settlements (Maltby 1989). The Roman cattle remains from Exeter support this study, though because of the low numbers of butchery marks on caprines and pig it is unclear whether the trend extends to these species. The use of heavy bladed tools increases the speed with which a carcass can be butchered (Seetah 2006), which once again points towards professional butchers supplying a consumer population. Additionally, although the evidence for sagittal splitting is scarce, it adds further support to the conclusion that professional butchers were present in Roman towns in England. Moreover, the close similarities between urban faunal assemblages, particularly the set ways that scapulae were treated, indicate that all urban butchers were taught the same methods, which can only happen when a skillset is passed down from master to pupil and traditions are adhered to. These observations confirm written records, which attest the presence of professional butchers and apprentices in the Empire (Rixson 2000). Nonetheless, carcass processing does vary slightly over time in Exeter, as can be seen in the differences between Roman military (phase 1) and Roman Civil (phase 2) chop mark locations, though these may be a result of the changing nature of the site as it changed from a military fortress to *civitas* capital. It should be kept in mind that carcass treatment is linked to specific species so a cow, pig, and red deer will not be treated the same way. While the evidence for this is limited due to the small amount of recorded butchery, it is nonetheless compelling.

5.3 Medieval

Table 5.4, 5.5, 5.6, and 5.7 show the proportions of butchered specimens for each species from the four medieval phases and the three site groups, and some trends are apparent from these numbers. Between cattle, caprine, and pig, cattle are in all phases and groups the most heavily butchered while pig comes second in phase 5 and 6. There is a steady decrease in proportion of butchered pig specimens over time, with none being recorded in phase 8, whereas the proportions of butchered caprine specimens remains fairly steady over time. Unfortunately, there is too little material from the South Quarter of Exeter to determine the overall trends for this area. It is unsurprising that cattle specimens have the highest frequency of butchery as a cow is physically larger than caprines or pig and was therefore likely to be divided into more portions. Where caprine specimens could be identified to either sheep or goat, the proportions range between 20% and 50% with only a single sheep outlier at 12.5%. As almost all specimens identified to either of the two species are horncores, the high proportions are not a reflection of overall amount of butchery, but rather the amount of horncores with evidence for removal from the skull. It is unclear what causes the patterns in the proportions between the groups or throughout time for the species, but it does highlight that the faunal material recovered from contexts in a high-status area (North Quarter) has different butchery trends compared to material from contexts located within or immediately surrounding ecclesiastic areas (West Quarter). Table 5.8 summarises the proportions of butchered specimens from the major livestock species, not including those identified to either sheep or goat, for the four phases and the groups. It shows that from phase 6 to 8, there is an increasingly larger difference in proportion of butchered specimens between the North and West groups with nearly double the proportion of specimens in the North group phase 8 compared to the West group. This pattern suggests that the high-status population was increasingly more likely to consume visibly butchered cuts than ecclesiastics.

TABLE 5.4: Phase 5 butchery types, amount, and proportion by species NISP and site group

North			
Species	**Type**	**Number**	**Proportion**
Cattle	Chop, cut	5	13.9%
Caprine	Chop	1	5.3%
Pig	Chop	2	8.7%
Roe deer	Chop	1	100%
Medium mammal	Chop, cut	2	9.1%
Large mammal	Chop	3	25%

TABLE 5.5: Phase 6 butchery types, amount, and proportion by species NISP and site group

North			
Species	**Type**	**Number**	**Proportion**
Cattle	Chop, cut	10	9.6%
Caprine	Chop	4	3.6%
Pig	Chop, cut	3	6.5%
Goat	Chop	2	50%
Large mammal	Chop	2	4.2%
Goose	Cut	1	33.3%
West			
Species	**Type**	**Number**	**Proportion**
Cattle	Chop, cut, saw	22	8.9%
Caprine	Chop, cut	5	2.8%
Pig	Chop, cut	3	4.5%
Goat	Chop	1	20.0%
Medium mammal	Chop, cut	2	8.3%
Large mammal	Chop	1	3.33%
South			
Species	**Type**	**Number**	**Proportion**
Cattle	Saw	1	33.3%
Caprine	-	-	-
Pig	-	-	-

TABLE 5.6: Phase 7 butchery types, amount, and proportion by species NISP and site group

North			
Species	**Type**	**Number**	**Proportion**
Cattle	Chop, cut	69	13.9%
Caprine	Chop	14	3.1%
Pig	Chop, cut	6	3.2%
Sheep	Chop, cut	5	41.7%
Goat	Chop	5	27.8%
Medium mammal	Chop	7	3.0%
Large mammal	Chop	12	7.1%
Chicken	Cut	1	0.9%
Goose	Cut	1	5.6%
West			
Species	**Type**	**Number**	**Proportion**
Cattle	Chop, cut	13	6.1%
Caprine	Chop, cut	5	3.5%
Pig	Chop	1	2.4%
Goat	Chop	2	28.6%
Medium mammal	Chop	1	3.7%
Large mammal	Chop, cut	3	10.7%
South			
Species	**Type**	**Number**	**Proportion**
Cattle	Chop, cut	8	7.0%
Caprine	Chop	2	4.3%
Pig	-	-	-
Large mammal	Chop	2	7.7%

TABLE 5.7: Phase 8 butchery types, amount, and proportion by species NISP and site group

North			
Species	**Type**	**Number**	**Proportion**
Cattle	Chop	21	18.3%
Caprine	Chop, cut	4	3.5%
Pig	-	-	-
Sheep	Chop	1	12.5%
Goat	Chop	1	50.0%
Fallow deer	Cut	1	33.3%
Horse	Chop	1	12.5%
Medium mammal	Chop	3	13.0%
Large mammal	Chop	5	27.8%
West			
Species	**Type**	**Number**	**Proportion**
Cattle	Chop	7	5.8%
Caprine	Chop, cut	4	5.1%
Pig	-	-	-
Medium mammal	Chop, cut	4	14.8%
Large mammal	Chop	4	44.4%
South			
Species	**Type**	**Number**	**Proportion**
Cattle	Chop	3	23.7%
Caprine	-	-	-
Pig	-	-	-

TABLE 5.8: Proportion of butchered livestock specimens by phase and group

	North	**West**	**South**
Phase 5	10.3%	-	-
Phase 6	6.5%	6.1%	-
Phase 7	7.8%	4.8%	5.8%
Phase 8	9.7%	4.9%	-

The overall pattern for recorded medieval butchery marks on cattle, show that the butchers focussed on separating the carcass at the joints by striking above, below, or through the joint, which is particularly apparent at the distal humerus, or across the neck of the scapula (Figure 5.9, 5.10, 5.11, 5.12, 5.13). No marks have been identified on proximal humeri, though this is likely due to the lack of identified specimens rather than a lack of butchery at this location. While phase 6 and 7 in the West Quarter represent ecclesiastic material and phase 8 and the whole North Quarter is high-status material, there are no indicators of this difference in the butchery patterns. The patterns are haphazard with no apparent system in how the joints should be separated compared to the highly systematic Roman trends. This is particularly apparent during phase 7 in the North group where a large number of marks was recorded, almost all of which are chop marks (Figure 5.11). Modification of the glenoid cavity of the scapula has been observed in a few cases, but none that follows the very distinctive pattern of trimming seen in the Roman period. Additionally, there is evidence of the removal of horn for cattle, sheep and goat, which was primarily done by a chop to the base of the horncore, particularly prevalent in goat, it is once again not as systematic as during the Roman phases.

A new type of butchery is recorded following the Norman Conquest on phase 6 cattle specimens from the West Quarter in the form of cutmarks placed just above or directly through the joint between the metacarpal and 1st phalanx, suggesting that the hoof was removed (Figure 5.10). This pattern is recorded more frequently in phase 7 primarily as cutmarks on both cattle and caprine metatarsals from the North and West Quarters, though chopping is also used on specimens from the North Quarter in phase 7. Across-the rest of the skeletal remains there is some variety in the location of butchery marks between cattle and caprines with the majority of chops on caprines located on the distal shaft of the tibia rather than the distal humerus, and there are no chops placed across the neck of the scapula (Figure 5.12).

Only a single North Quarter phase 7 large mammal vertebra had been sagittally split, and an additional five were identified amongst the phase 8 material form the West Quarter. The lack of phase 5 and 6 evidence for halving carcasses suggests that the practice went out of use after the end of the Roman occupation and did not reoccur until the second half of the 12^{th} century after Exeter had gained considerable wealth and status following the Norman Conquest. This indicates that the practice of sagittal splitting is linked to population growth or wealth creating a demand for quick and efficient butchery methods, which is further supported by sagittal splitting primarily occurring in urban sites as opposed to castles (Foster 2016) and rural sites. Nonetheless, the small number of identified cases alongside the rather haphazard way of dividing carcasses into joints can suggest several different things. One option is that butchery was done by the individual household rather than by procuring meat from professional butchers; second, there may not have been a systematic way of training butchers, or third, that speed was more important than obtaining identical joints of meat. Interestingly, when looking at the butchery patterns at the Acorn site located just outside the City Wall by the South Gate, the chop marks recorded on the scapula are very similar to those of the Roman phases indicative of trimming the shoulder in preparation for smoking or brining (Figure 4.6) hinting that a variety of butchery styles, and probably professional butchers, may be present in medieval Exeter, though it is difficult to distinguish the styles from one another.

Neither Maltby or Levitan discuss their recorded butchery in terms of specific date brackets, though it is apparent that they both saw concentrations of marks around the joints, particularly on the scapula, humerus-radius, pelvis-femur, and tibia-tarsal joints, and Maltby further notes that the mid-shaft of the tibia was particularly frequent in caprines (Levitan n.d. a; Maltby 1979). Levitan's butchery records from Exe Bridges and St Katherine's Priory display almost identical patterns to the North and West Quarters, further highlighting that butchery practices are not specific to site location or status during the medieval period in Exeter (Levitan 1987, Figure 11 and 12).

The location of butchery marks, and the frequency in which they occur, vary between urban settlements across England, hinting at regional or town specific butchery practices and preferences for certain joints of meat. In Anglo-Saxon York, the cattle butchery practices also show minimal development over the period, but unlike in Exeter, there is much more frequent evidence for sagittal splitting and transverse chops across the cervical vertebrae (O'Connor 1989, Figure 24). This could mean that a larger number of professional butchers were present in York at a time where there is minimal evidence for them in Exeter, which hints at the differences in wealth between the two towns prior to the Norman Conquest.

At the Manor House excavations in Ilchester, the patterns for chops on both cattle and caprines appear to be similar to Exeter, though there are not enough cases of cutmarks from Exeter to determine if these patterns are similar as well (Levitan 1994, Figure 66, 67, and 68). Interestingly, Ilchester is a relatively close by settlement to Exeter, at least compared to the other towns and cities mentioned here, suggesting that the similarities in butchery patterns may be regional rather than town specific. London and Oxford also show similarities to Exeter, with cattle being the most heavily processed, chopping the preferred method, and only a small number of cut marks being recorded, and when present, they are more likely to occur on caprines and pigs than cattle (Armour-Chelu 2003; Rielly 2001). While the specific butchery type is not mentioned in the analysis of the faunal material from Saxon Southampton, the general description is remarkably similar to what is seen in Exeter. Bourdillon and Andrews (1997) describe it as 'rough and ready', located in many different places on the bone and in a variety of directions, though a few examples seemed more controlled and neat.

Similarities can clearly be found between Exeter and any other urban medieval site where detailed butchery recordings have been made, but unlike the Roman periods, there are also differences which probably evidence the change England went through after the decline of the Roman Empire and throughout the following centuries where considerable wealth was gained or regained in many settlements. The highly systematic butchery methods were abandoned after the departure of the Romans and a less organised practice took its place which continued for multiple centuries. The base method of striking with a heavy bladed tool at the joints and on some shafts, appears to be present on all urban sites but with variation in where the chops are the most frequent and in how consistent the location and direction of the marks are. The greatest variation is seen in the presence/absence and frequency of sagittal splitting. Some sites are like Exeter, with a complete absence or very small numbers of split vertebrae in the early part of the period and then an increase over time. Then there are settlements like York, where, even in the

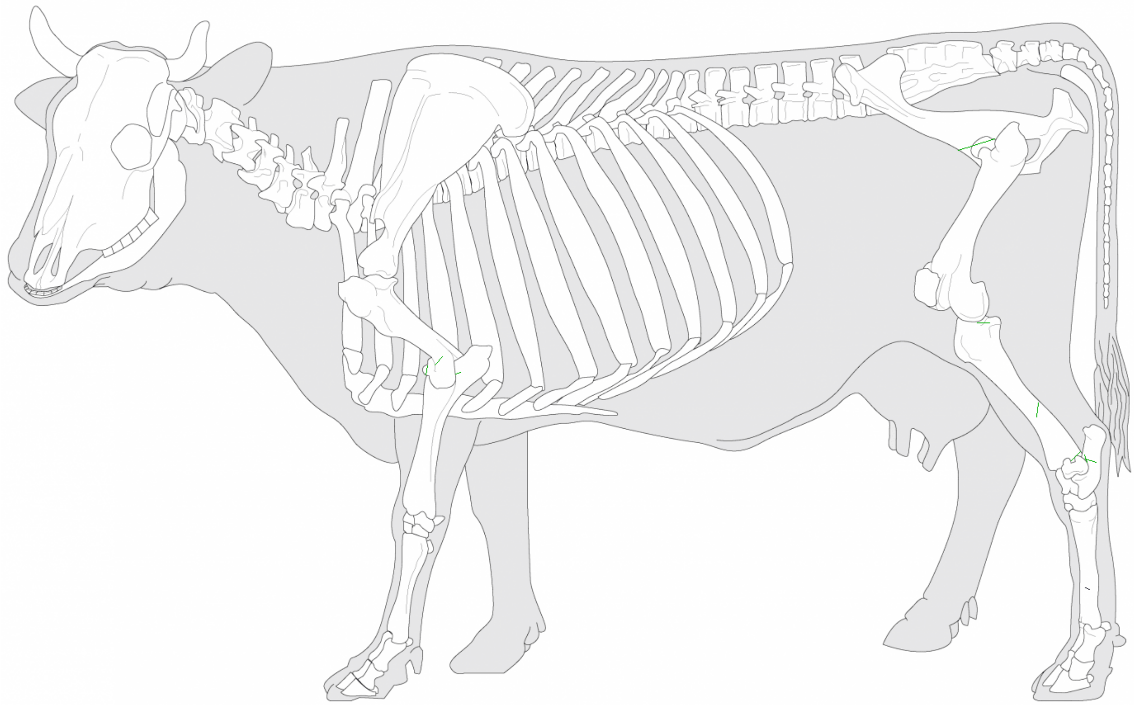


FIGURE 5.9: North Quarter phase 6 cattle butchery. Key: green - chop; blue - cut

Anglo-Saxon period, the splits are frequently seen as attesting to the presence of a large enough population to sustain professional butchers with designated building space for their practice.

Skeletal part abundances use much more abundant data than butchery, meaning comparisons can be made between the three main species in almost all phases, though data are not always available for all quarters (Figure 5.15, 5.16, and 5.17). Where data are available for more than one quarter, there is variation in the abundances for all three species between different quarters. For the three species there is a noticeable lack of metapodia in the phase 5 material, which unfortunately, is only available for the North Quarter. This pattern is highly indicative of household waste, with no primary butchery waste, suggesting that no primary butchery was undertaken and professional butchers did not operate in this area during phase 5. Moving into phase 6 for cattle, the whole carcass is represented for both the North and West Quarters, and most elements are represented in fairly equal frequencies in the two quarters. The main differences between the two areas are seen as the West Quarter having higher frequencies of mandibles, metacarpals, and calcanei, including slightly more humeri, whereas the radii and femora are more likely

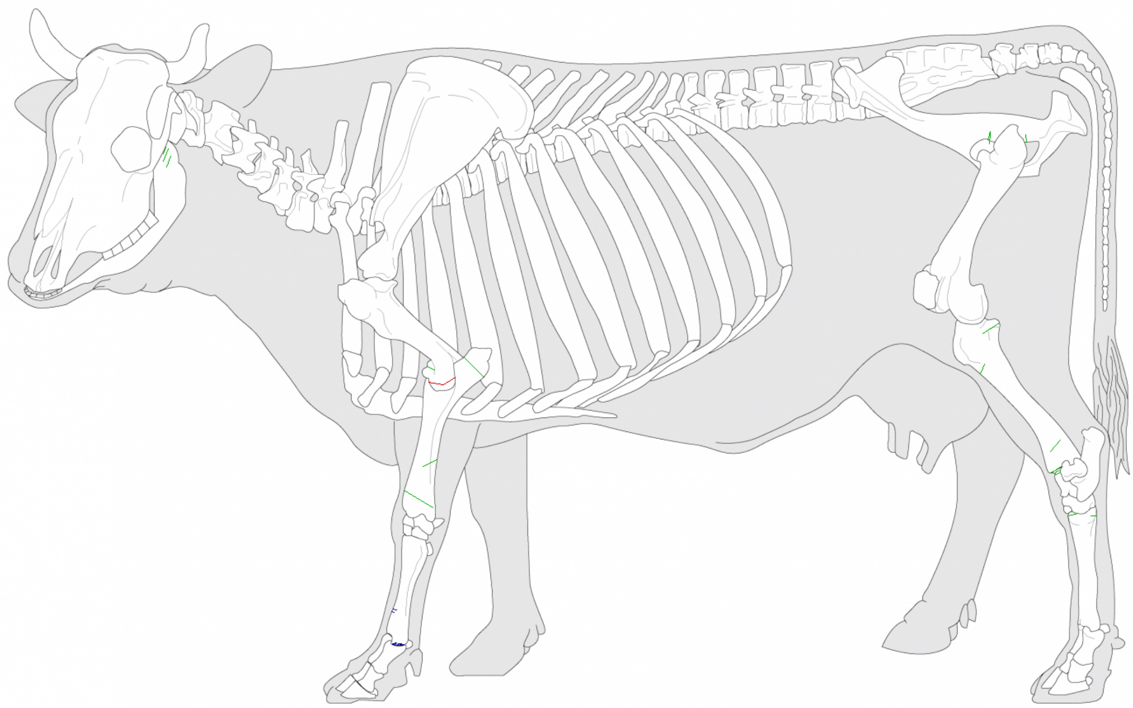


FIGURE 5.10: West Quarter phase 6 cattle butchery. Key: green - chop; blue - cut

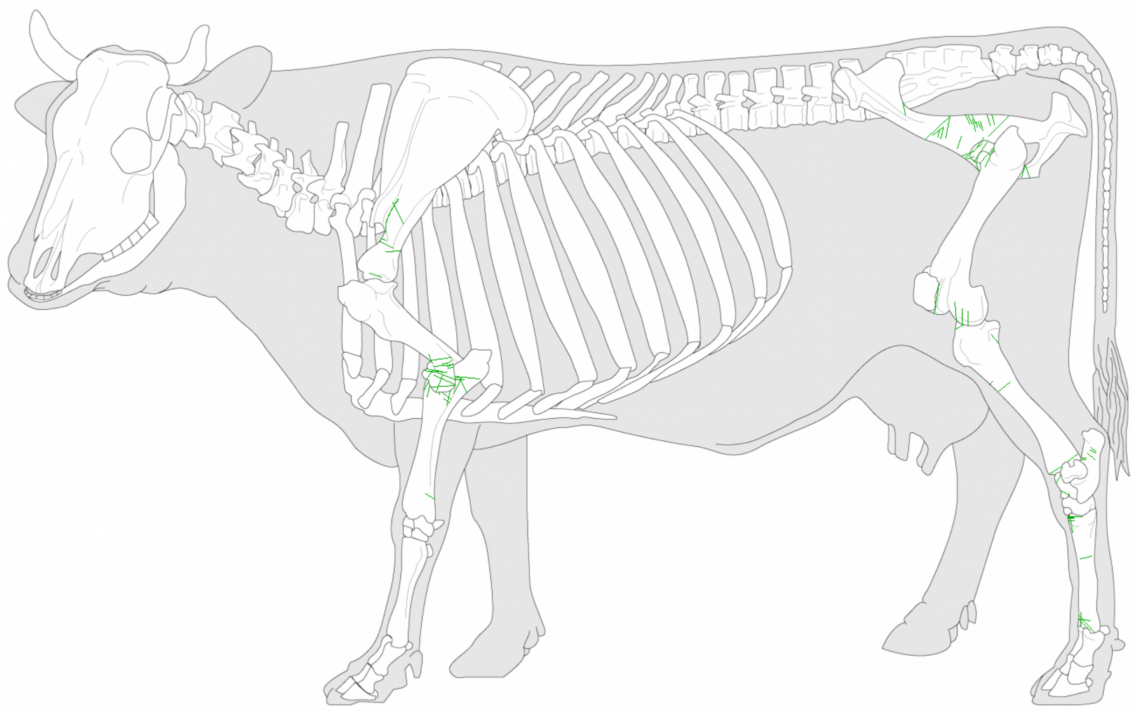


FIGURE 5.11: North Quarter phase 7 cattle butchery. Key: green - chop; blue - cut

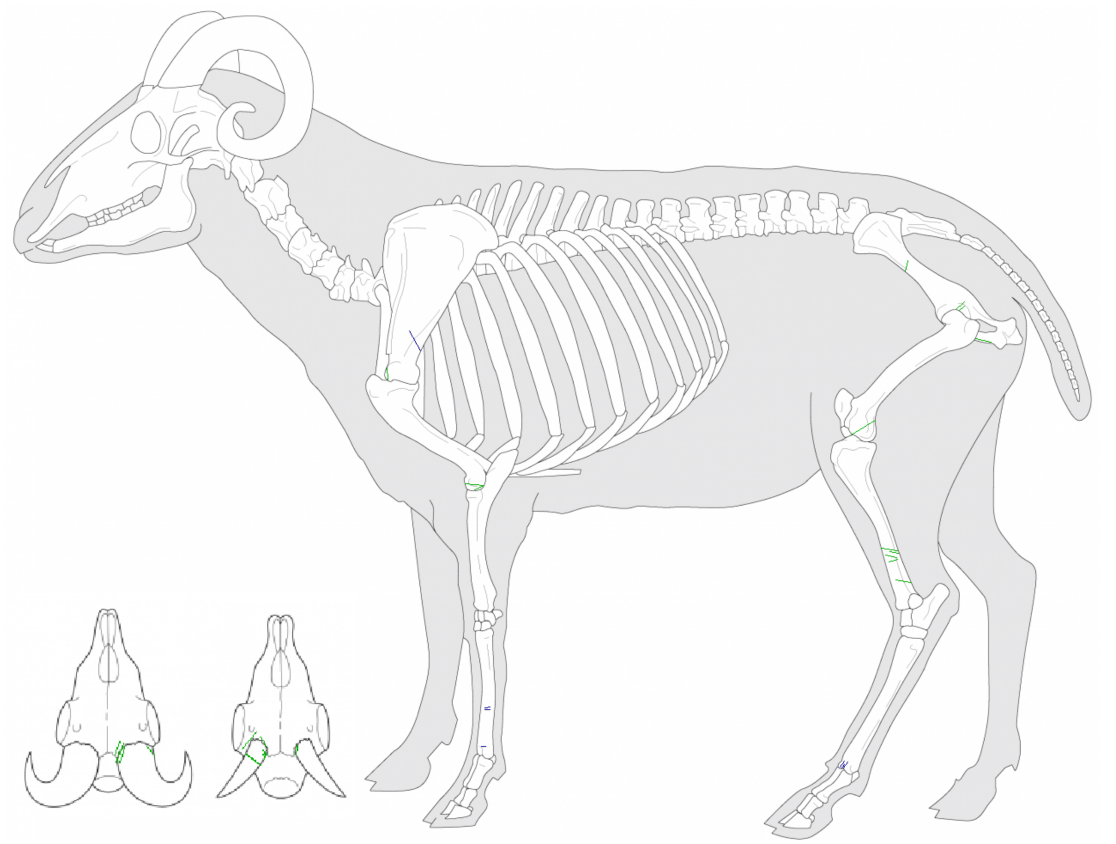


FIGURE 5.12: North Quarter phase 7 caprine butchery. Key: green - chop; blue - cut

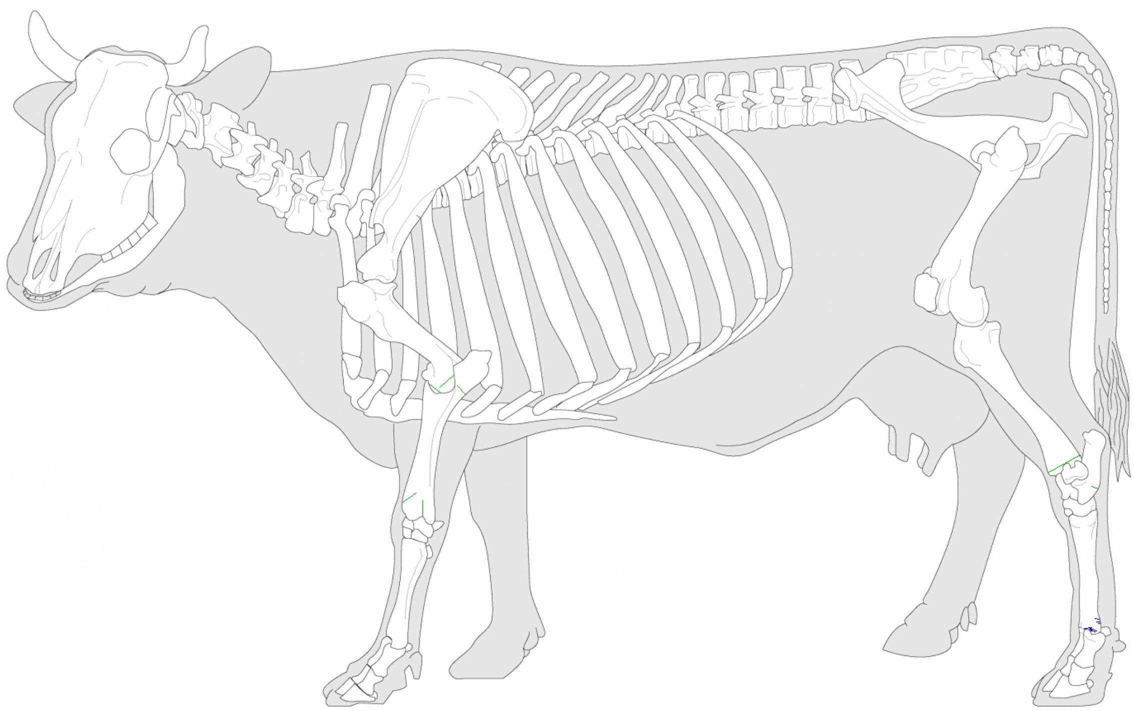


FIGURE 5.13: West Quarter phase 7 cattle butchery. Key: green - chop; blue - cut

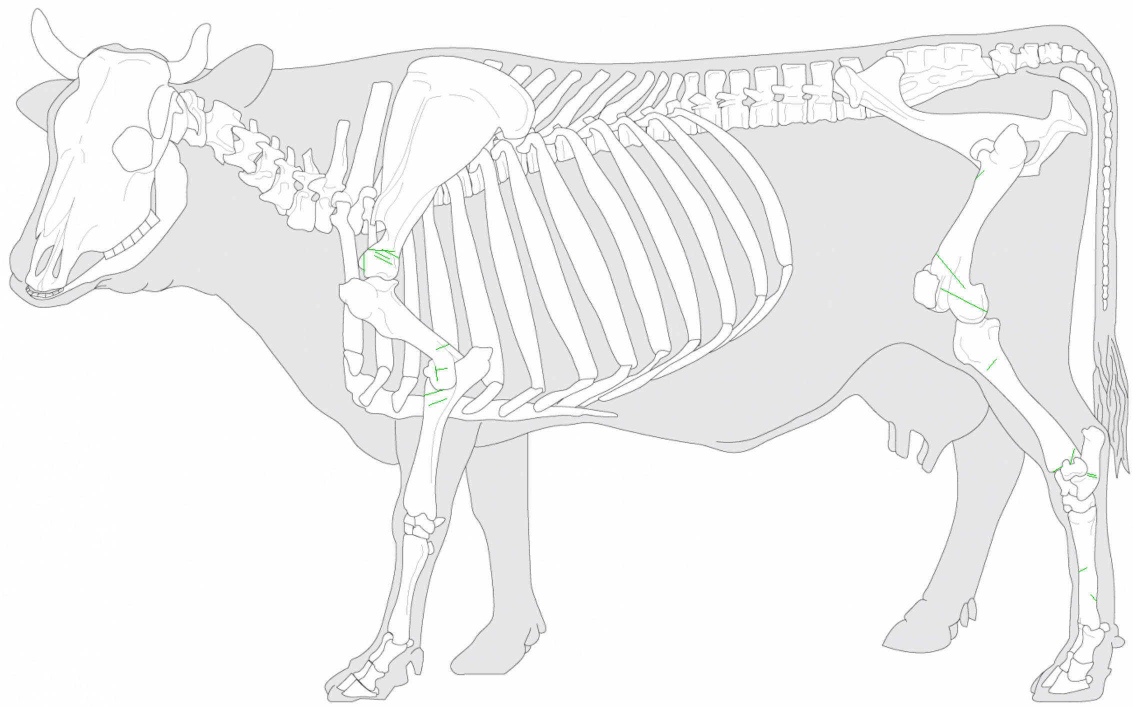


FIGURE 5.14: North Quarter phase 8 cattle butchery. Key: green - chop; blue - cut

to be found in the North Quarter.

The pattern for phase 6 caprines is similar with metatarsals being much more frequent in the West Quarter than the North, whereas tibiae are the opposite. The main difference lies in the prevalence of the front and hind quarters. In the North Quarter, elements from the front of the animal are the more frequent, apart from tibiae which have the highest proportion of all elements, whereas in the West Quarter, the elements occur in fairly equal frequencies when taking recovery biases into account. The patterns for cattle and caprines suggest that primary butchery waste was more likely to be found in the ecclesiastic area, though the general diet of the ecclesiastics and probable high-status population was very similar.

Phase 6 pig abundances show the greatest variation between the two quarters, particularly for ulnae, tibiae, and astragali. The first two are relatively much more frequent in the West Quarter and astragali the most frequent in the North Quarter; furthermore, scapulae are noticeably more common in the West Quarter though to a lesser degree than the other elements. These trends cannot be explained by household versus primary

FIGURE 5.15: Cattle skeletal part abundances by phase and quarter.

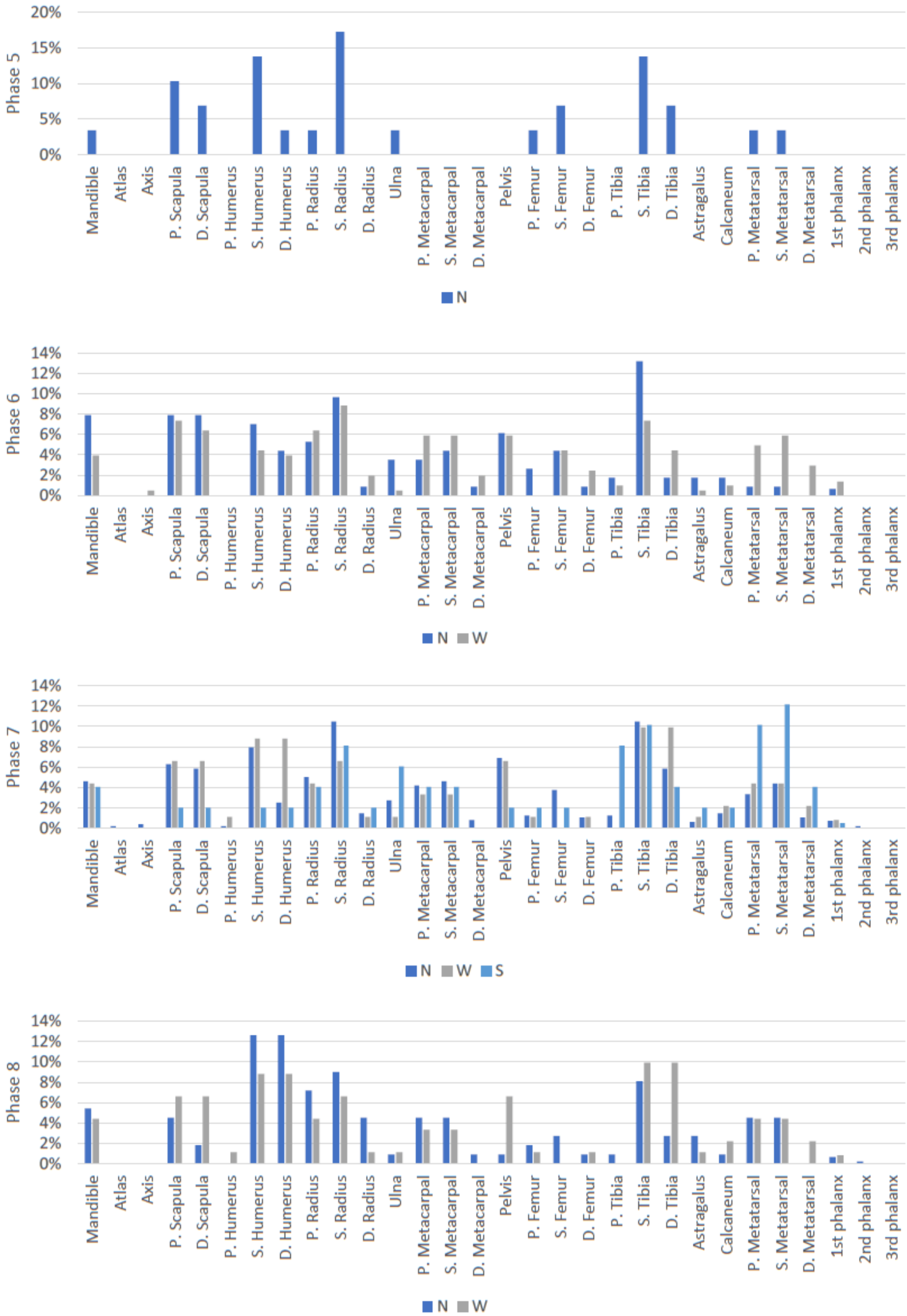


FIGURE 5.16: Caprine skeletal part abundances by phase and quarter.

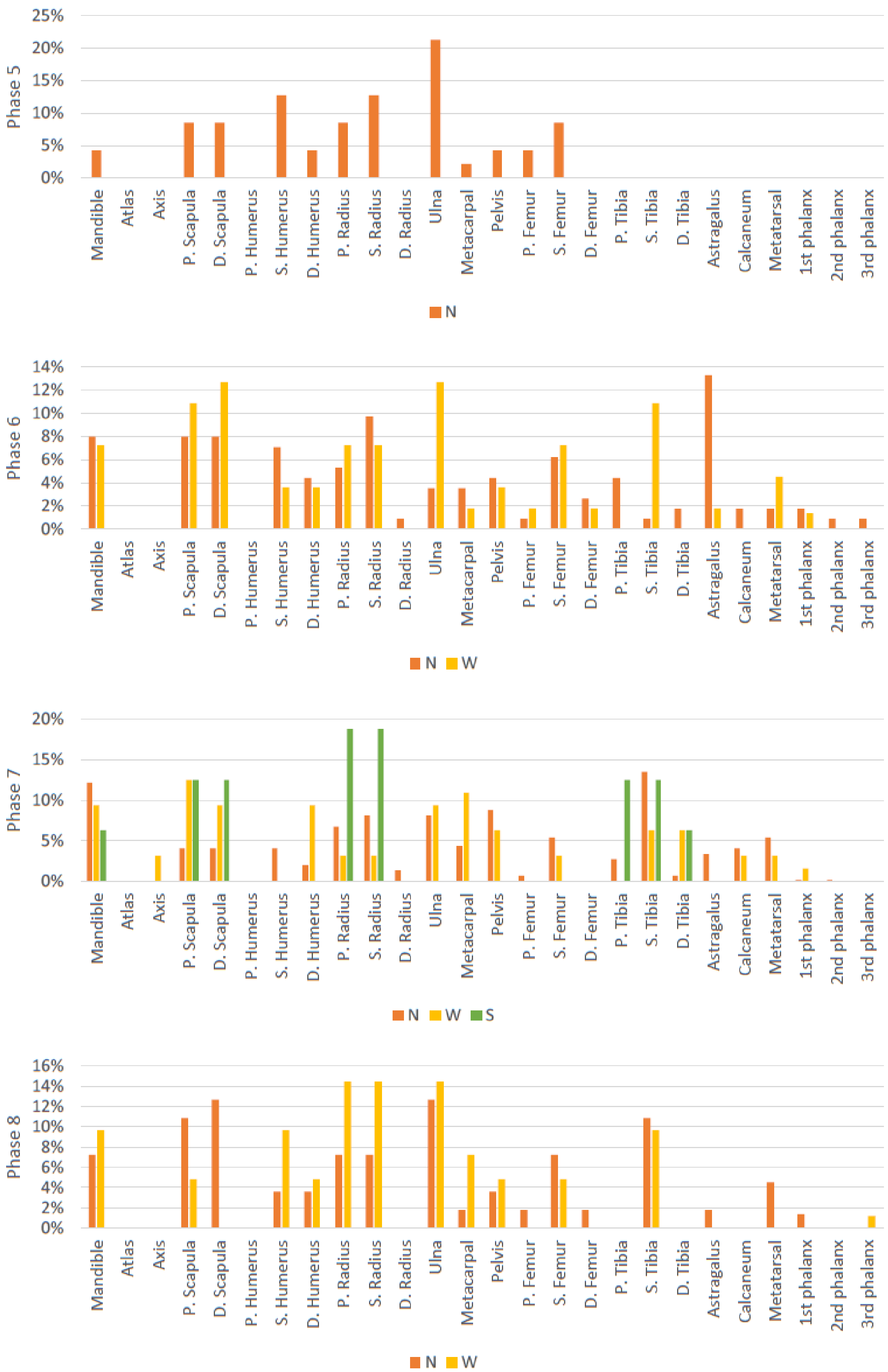


FIGURE 5.17: Pig skeletal part abundances by phase and quarter.

butchery waste, as the high proportion of astragali in the North Quarter is the only indicator of low utility elements being particularly frequent. Therefore, it may be a reflection of differences between ecclesiastic and high-status dietary preferences for pork or differential access to particular joints of meat. Interestingly, the patterns for either quarter are not traditionally what would be considered purely 'high-status' diets as the most frequently occurring elements, radius, ulna, tibia, and astragalus, have lower meat yields than the humerus and femur; the only exception to this is the scapula which occurs in high numbers. The most obvious explanation for this it that the material, especially from the North Quarter, does not only reflect the diets of high-status citizens, but rather a mix of the population. This is to be expected as high and lower status families would live in close proximity of each other (John Allan, pers. comm.) and the archaeological material has not been divided with regards to the particular tenements the material was recovered from. With this in mind, and reflecting back on the phase 6 cattle and caprine patterns, it suggests that pig abundances are more likely to reflect differences in consumption within the population than cattle and, to a lesser extent, caprines.

All three quarters are represented in the phase 7 material and once again, there is some variation in the abundances depending on which quarter is looked at. For cattle, there are minimal differences between the North and West Quarters, though hind leg elements are more frequent in the West Quarter, whereas there is a more even distribution between all elements in the North Quarter. This once again demonstrates that in terms of element abundances, high-status and ecclesiastic deposits are very similar. The South Quarter is distinctly different from the other two as meat yielding elements, apart from scapulae, occur in low frequencies, and metapodia, particularly metacarpals, occur in the highest frequencies. Caprine metatarsals are also very frequent in the South Quarter with all abundances for the other two quarters once again being very similar. The South Quarter being different from the North and West suggests that the people that lived here either had a different diet, that butchers operated in this area, or that craft activities were particularly common here. The second option seems the most likely as there is no evidence to suggest that any of the metapodia identified were used for tool or object making.

As in all other medieval phases, the phase 7 pig abundances are different to cattle and caprines. Four pig elements have been identified in the South Quarter, only one of them high meat yielding, suggesting that the population living in at least the most southern part of this quarter where the material is from, were of lower status. As no other elements were identified it indicates that they were acquired as joints of meat, rather than having access to whole pig carcasses which appears to be the case in the North and West Quarters. Along with the higher concentrations of metapodia, it is the first highly indicative evidence of professional butchers operating in medieval Exeter and it looks like the South Quarter residents were more likely to obtain already processed joints than the people in the North and West Quarters.

In phase 8, there is a considerable shift in the cattle abundances compared to the pervious phases. Scapulae, pelves, and metapodia show the greatest differences between the North and West Quarters. Scapulae and pelves are much more frequent in the North Quarter compared to the West Quarter, whereas metapodia are the most frequent elements in the West Quarter, but they are completely absent from the North Quarter. Caprine abundances are fairly similar between the two quarters, with humeri being particularly frequent in the North Quarter and pig scapulae also showing a considerable difference between the quarters as they are very frequent in the North, but only occur in low frequencies in the West. As both quarters are high-status in this phase, as opposed to ecclesiastic and high-status where there were minimal differences, it shows that status was not synonymous with particular elements being very frequent. It rather underlines that the archaeological record is complex and the presence of primary butchery waste and lower utility elements are common in almost all phases and quarters and there is no clear division between the various aspects of the medieval urban population. Unfortunately, there is minimal comparative ecclesiastic medieval material from Exeter, but when comparing the phase 7 intermural material to the extramural Acorn site, it is once again apparent that there are differences in the abundances (Figure 4.4). A closer examination shows that the greatest differences are between Acorn and the North and West Quarters, while there is a rather close similarity to the South Quarter. This suggests that the Acorn area was also a lower status settlement with probable industrial or craft activities. At Exe Bridge this is further emphasised as the 13^{th} century (phase 7) material is dominated by industrial waste from horn working with nearly 70% of all cattle specimens and nearly 40% of all caprine specimens coming from horncores (Levitan 1989, Figure 2). It further supports that these types of activities happened outside the city walls even though the products were probably used within the walls. Similar to the variations in butchery patterns in other English urban settlements, skeletal part abundances also show differences, though keeping in mind the various patterns that can be found within a single town, this is to be expected, as material from one or two excavations is unlikely to be representative of a whole settlement.

Confining certain activities to specific areas has also been noted in York among other places (Bond and O'Connor 1999). For example, in the late Saxon (phase 5) caprine element abundances from Lincoln, major meat-bearing bones are frequent, similar to Exeter, but metapodia are the most common, whereas in Exeter, where, at least in the North Quarter, none have been identified (Dobney et al. 1995). Nonetheless, the same preference for front limb elements has been observed as well, and a comparison between sites also showed differences in material from similar dates.

There are differences in butchery marks and skeletal part abundances between phase 5, 6, and 7, though they are minimal, reflecting a long- term continuation of butchery practices and preferences for meat joints that lasts from the beginning of the 10^{th} to the end of the 13^{th} century. Distinct changes to not occur until the 14^{th} and 15^{th} centuries (phase 8), where sagittal splitting becomes increasingly more frequent, there is preference for specific joints of meat, and differences between the quarters become much more apparent. To generalise, all deposits from within the Exeter City Walls clearly represent most walks of life. There are signs of the operations of professional butchers with the reintroduction of specialised techniques such as sagittal splitting and distribution of meat joints, particularly from phase 7 (1150-1300) and onwards. Unsurprisingly, being within the city walls and proximity to the castle seems to have had an effect on status, with sites in close proximity to the castle having the highest status. For example, the West Quarter is more likely to have primary butchery waste and therefore 'working people', whereas in the North Quarter, where the castle is located, this is missing almost entirely. This will be discussed further in the following chapters with regards to the various types of evidence.

5.4 Post-medieval

The material from the post-medieval period is much sparser than in the previous two periods allowing for minimal comparison between the quarters (Table 5.9 and 5.10). The vast majority of the evidence is from phase 9 (1500-1650) in the North Quarter and very little material has been recovered from the West Quarter and none from the South Quarter. In Table 5.9, it is clear that rib and vertebral specimens (large and medium mammal) have the highest proportions of butchery marks, all of which are chops. This is followed, in order, by cattle, caprines, pigs and lastly birds, with cattle at 15.7% having a markedly higher proportion of specimens with visible butchery marks than any the other species. these two trends combined show that vertebrae and ribs are much more likely to show signs of butchery than any elements that can be identified to a specific species such as long bones. Overall, there appears to be an increase from the medieval period in proportions of butchered specimens for each of the major livestock species and medium mammal specimens. A single post-medieval saw mark was identified to phase 10 (1650-1800). This is located on the distal shaft of a cattle metapodium.

The recorded phase 9 butchery marks on cattle and caprine limbs (Figure 5.18 and 5.19) show that the species were treated differently which is particularly evident at the proximal femora, which is the most abundant location on caprines. On cattle the marks are primarily located at base of the femoral head but with no apparent system to the pattern, whereas on caprines the method is highly systematic with a single chop placed across the proximal articulation just below the acetabulum. Similar to the medieval phases, the cattle butchery appears rather haphazard with little consistency in the location of chops, though it is even more pronounced in phase 9 than previously (for example, see Figure 5.11). The main trend that is apparent in phase 9 is that almost all marks on long bones occur directly above or below articulations, rather than going through the joint itself. While there are few marks recorded on the other limb bones of caprines, the same trend seems to be visible.

TABLE 5.9: Phase 9 butchery types, amount, and proportion by species NISP and site group

North			
Species	**Type**	**Number**	**Proportion**
Cattle	Chop, cut	59	15.7%
Caprine	Chop, cut	37	9.4%
Pig	Chop, cut	6	6.4%
Medium mammal	Chop	53	25.6%
Large mammal	Chop	36	26.5%
Domestic fowl	Cut	2	1.6%
Goose	Cut	1	5.6%
West			
Species	**Type**	**Number**	**Proportion**
Cattle	Chop, cut	8	17.4%
Caprine	Chop	5	10.9%
Pig	-	-	-
Medium mammal	Chop	4	25%
Large mammal	Chop, cut	6	75%
South			
Species	**Type**	**Number**	**Proportion**
Cattle	-	-	-
Caprine	-	-	-
Pig	-	-	-

TABLE 5.10: Phase 10 butchery types, amount, and proportion by species NISP and site group

North			
Species	**Type**	**Number**	**Proportion**
Cattle	Chop, saw	4	7.5%
Caprine	Chop	2	3.6%
Pig	Cut	1	8.3%
Large mammal	Chop	2	40%
West			
Species	**Type**	**Number**	**Proportion**
Cattle	Chop, cut, saw	10	14.3%
Caprine	Chop, cut	4	5.6%
Pig	-	-	-
Medium mammal	Chop, cut	2	9.5%
Large mammal	Chop	1	10%
South			
Species	**Type**	**Number**	**Proportion**
Cattle	-	-	-
Caprine	-	-	-
Pig	-	-	-

A new interesting pattern is also visible on a caprine femur and two humeri and can be seen on Figure 5.19 as series of cuts circling the mid-shafts of the humerus and femur. This is likely to be what can in modern day cuisine be called a French trim or 'Frenched' – often done with a rack of lamb, which trims away the meat at the end of a joint to expose the bone for visual effect (Swatland 2004). If this type of butchery is indeed French, it is a testament to Exeter's connections with the Continent that were solidified along with the wool trade.

A few chops were identified on caprine atlases, most of which were on the posterior articulation, suggesting that the first few cervical vertebrae were rarely sagittally split along with the rest of the spine. Additionally, there is no evidence that the heads were removed from the spine by cutting or chopping through the atlas or axis. Very few caprine occipitals have been recovered, so it is still unclear how the head was removed from the rest of the body, though a few transverse chops on other medium mammal cervical vertebrae suggest that part of the neck could have been removed with the head (Figure 5.23). Corresponding evidence is not available for cattle and large mammals, so other techniques may have been employed (Figure 5.22). The large number of sagittally split vertebrae of both medium and large mammals clearly show the increasing importance of this method which was also noted to be an established post-medieval practice by Maltby (1979). Opposite to the long bone butchery, here the chops on large mammal specimens are much more consistent in location compared to those on medium mammal ones (Figure 5.22 and 5.23). This may be a result of the physical weight of the carcasses. A cow weighs more than a sheep, so when hung up, a cow will move around less during butchery than a sheep. A few transverse chops on both animal size groups suggest that the spine was probably divided into shorter lengths. This is once again a method that is common in modern butchery practices and has been recognised in medieval, post-medieval, early 19^{th} century and modern English and continental material, attesting to this long-lived and widespread practice (Audoin-Rouzeau 1987; Rixson 2000; Swatland 2004; Symons 2002).

There also appear to be slight variations in the ways medium and large mammal ribs were butchered, though the evidence is minimal, so it may not be representative of all rib butchery practices (Figure 5.20 and 5.21). As ribs are prone to fracturing and only specimens with heads were recorded for this study, any marks occurring on the anterior/ventral half of the shaft are unlikely to have been recorded. The ones that have been recorded on the posterior/dorsal half of the rib show that almost all on medium mammal specimens are located on the medial aspect, so the animals must have been gutted first before the ribs were butchered, and it was likely done while the carcass was hanging as it is difficult to do if it is lying on a surface. On large mammal specimens, chops are located both on the medial and lateral sides showing more variability in method of rib butchery, and unlike medium mammal ones, there are marks on the medial side of the rib head showing that at least some ribs would have been removed entirely from the spine producing a rib cut similar to a modern 'top rib' cut (Swatland 2004).

Unlike in the Roman and medieval periods, no evidence of horn processing has been identified in the post-medieval phases in any of the quarters or at the Haven Banks and Good Shepherd Hospital sites outside the city walls suggesting a drastic change from the medieval industry in Exeter. Similarly, Maltby and Levitan have not identified any great horn core concentrations, so the general lack of them across Exeter may be a result of the wool trade which likely took precedence over any other industries based on animal by-products. While industrial waste has been identified in other post-medieval urban settlements elsewhere (O'Connor 1984), the absence of it, and domestic waste, is not a trend unique to Exeter. A possible explanation is a shift in waste disposal methods, which can potentially account for the lack of material recovered from any of the other quarters as well as industrial waste from both inter- and extramural sites in Exeter and elsewhere. This possibility will be discussed further in chapter 8. Due to the scarcity of post-medieval material, it is not possible to explore similarities and differences between butchery patterns in domestic waste from Exeter and other urban sites in England at this point in time.

The skeletal part abundances for phase 9 and 10 are presented in Figure 5.24, 5.25, and 5.26. As mentioned previously, there is very little faunal material outside of the North Quarter, so where data have been included from the South and West Quarters they can only provide a tentative picture of the trends in these areas. Despite the data

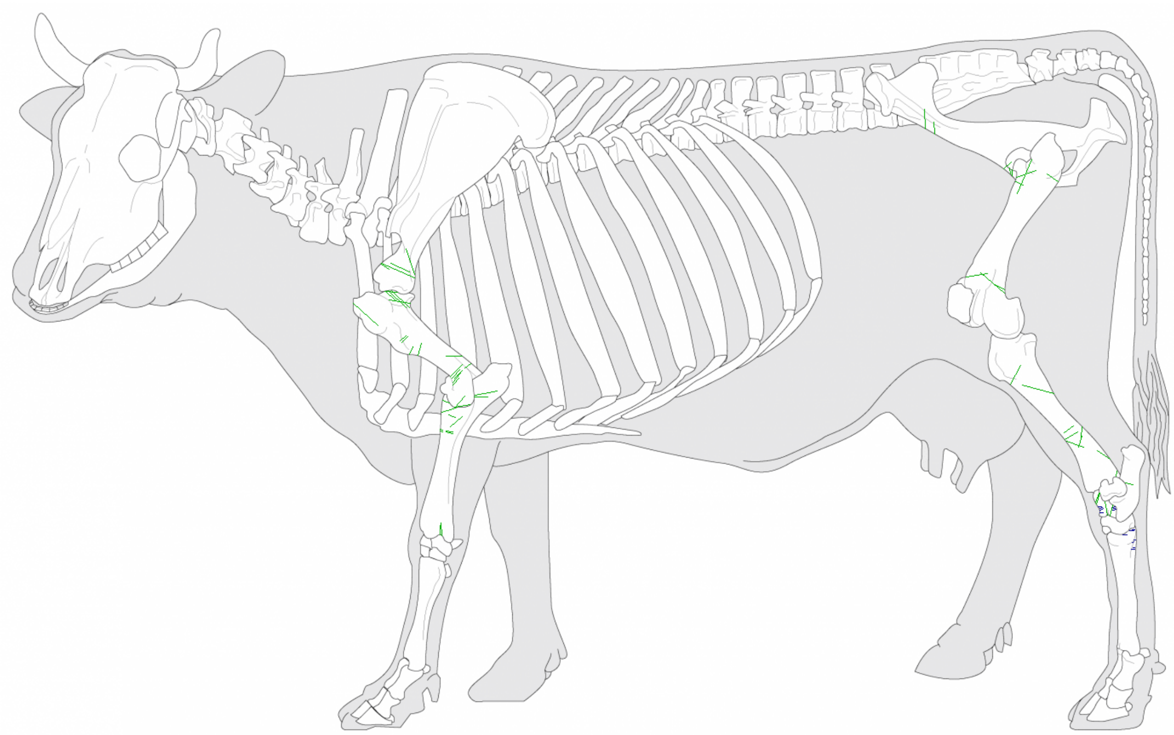


FIGURE 5.18: North *Quarter phase 9 cattle butchery. Key: green - chop; blue - cut

being scarce, it is clear that there is once again distinct difference between the quarters in terms of cattle and caprine abundances.

The phase 9 cattle shows an unprecendented high proportion of femora in the South Quarter while all other elements occur in fairly even amounts. On the other hand, the caprine material shows a completely different pattern, with the North and South Quarters having very similar proportions across the majority of elements, but there is a very clear preference for humerii and radii suggesting that the population had the option to acquire this joint alone, rather than whole carcasses which appeared to be the common practice for cattle. Additionally, pig appears to have a similar pattern to caprines. In phase 10, the patterns have shifted again, more so for cattle than caprines, particularly from the North Quarter. Caprine abundances are now fairly even for most long bones in both the North and West Quarter, but in the North Quarter, humerii are twice as frequent as the second most abundant element. There is also a distinct lack of low utility elements, suggesting that the material is almost entirely food waste and all primary butchery waste was disposed elsewhere unlike the phase 9 material where it is more a mix of waste types.

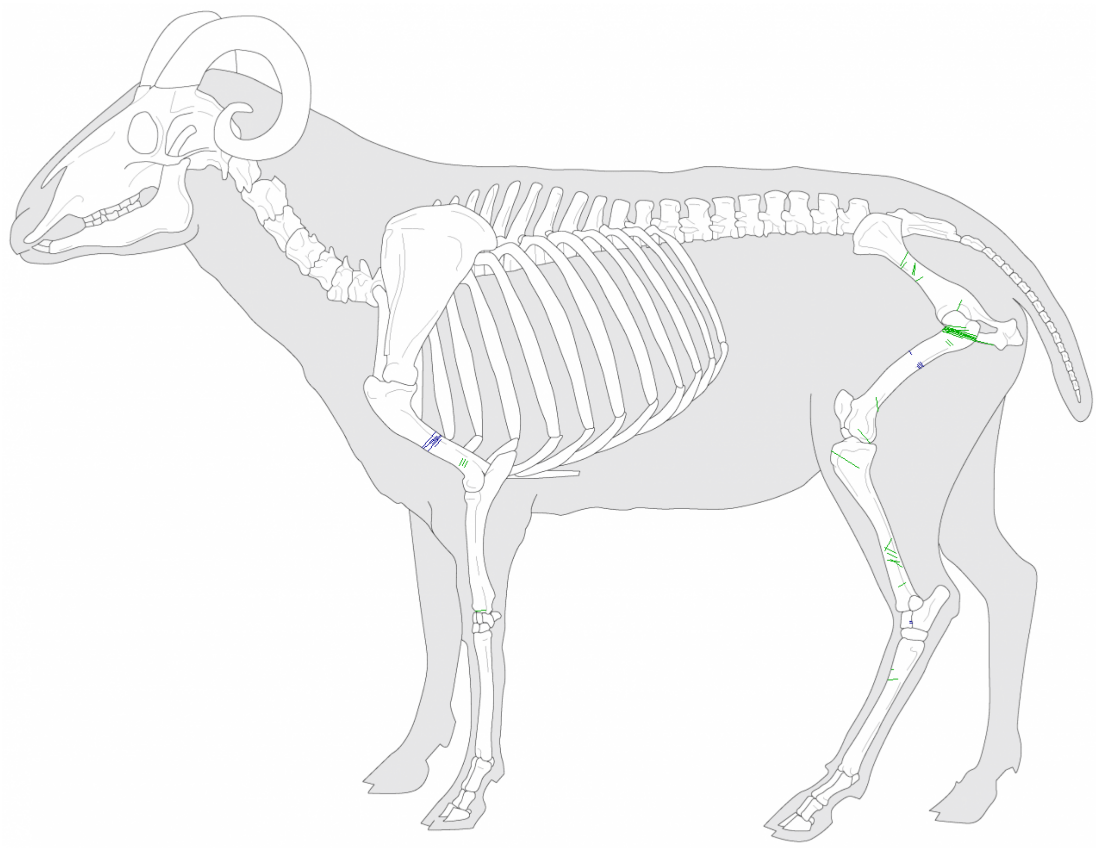


FIGURE 5.19: North Quarter phase 9 caprine butchery. Key: green - chop; blue - cut

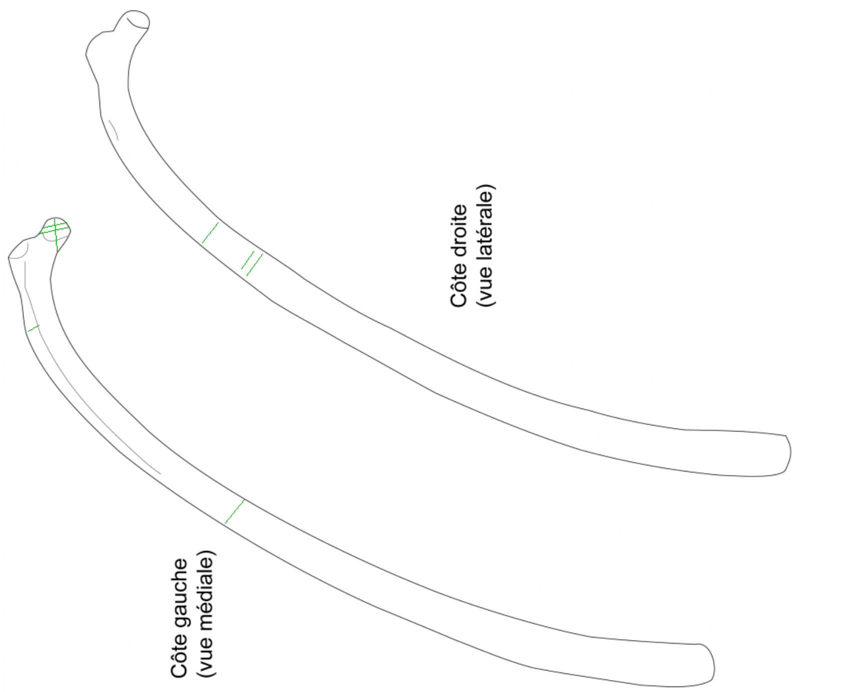


FIGURE 5.20: North Quarter phase 9 large mammal rib butchery. Key: green - chop

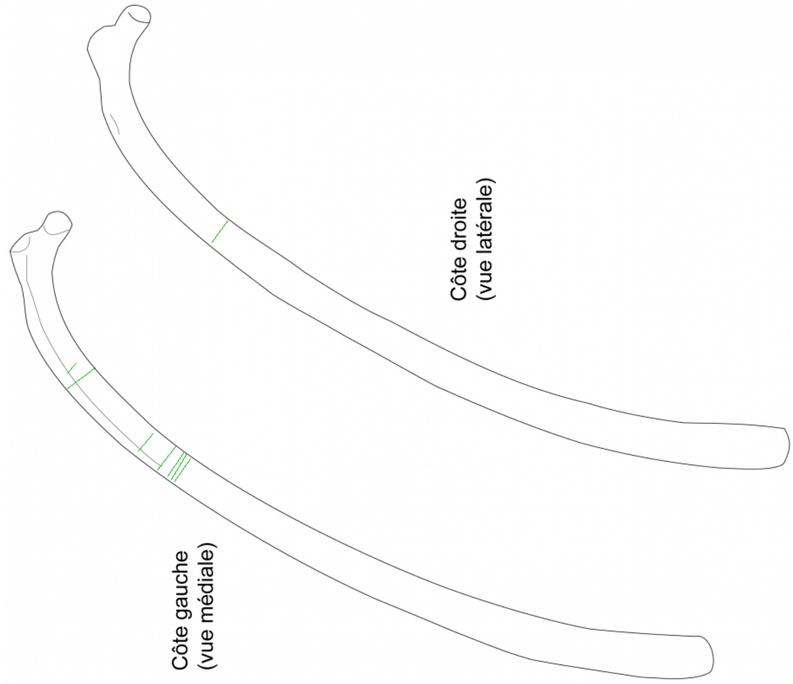


FIGURE 5.21: North Quarter phase 9 medium mammal rib butchery. Key: green - chop

In contrast, West Quarter cattle show a presence of metapodia and phalanges alongside tibiae and femora, whereas the North Quarter humerii are once again, by far, the most frequent element. Similar to the medieval period, cattle and caprines were clearly treated differently and occured in different patterns in each of the quarters.

In the post-medieval period, patterns and trends shift at a much more rapid pace and in a more drastic manner than in the previous two periods. This could be a reflection of a growing 'consumer mindset' with clear preferences for specific cuts and types of meat. The material from St. Katherine's Priory, dissolved in 1539, approximately 1.5 miles outside the city walls, suggests that the trends from central Exeter do not all reach the local population in the surrounding area (Levitan 1989). Cattle metapodia and tarsals are by far the most frequent followed by tibiae, with all other limb elements being considerably less frequent, whereas for caprines, humerii, radii, and tibiae are the most numerous which is very similar to in central Exeter. While the caprine frequencies are similar to phase 9, the cattle patterns are very different and resembles primary butchery waste deposits apart from the high numbers of tibia (Levitan 1989, Table 5 and 6). Levitan has interpreted this as the priory buying in half or whole cattle carcasses and butchering

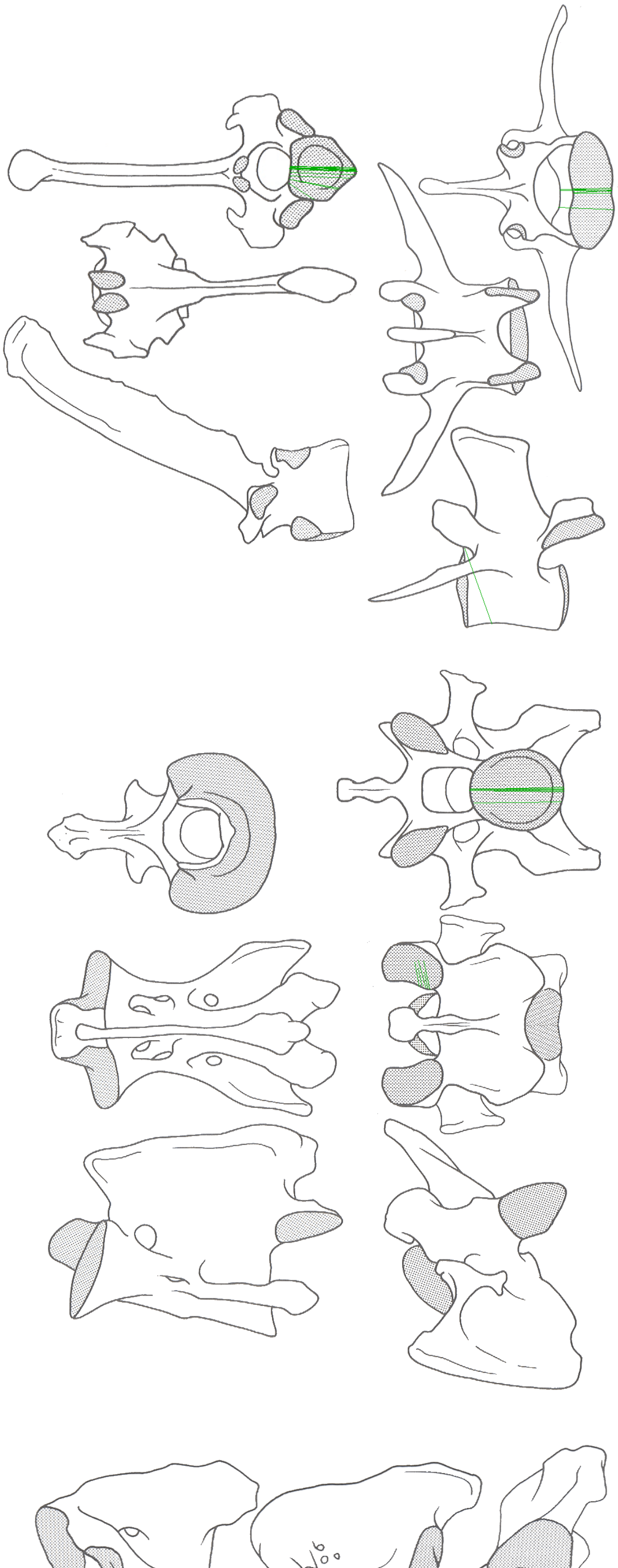


FIGURE 5.22: North Quarter phase 9 large mammal vertebrae butchery.
Key: green - chop

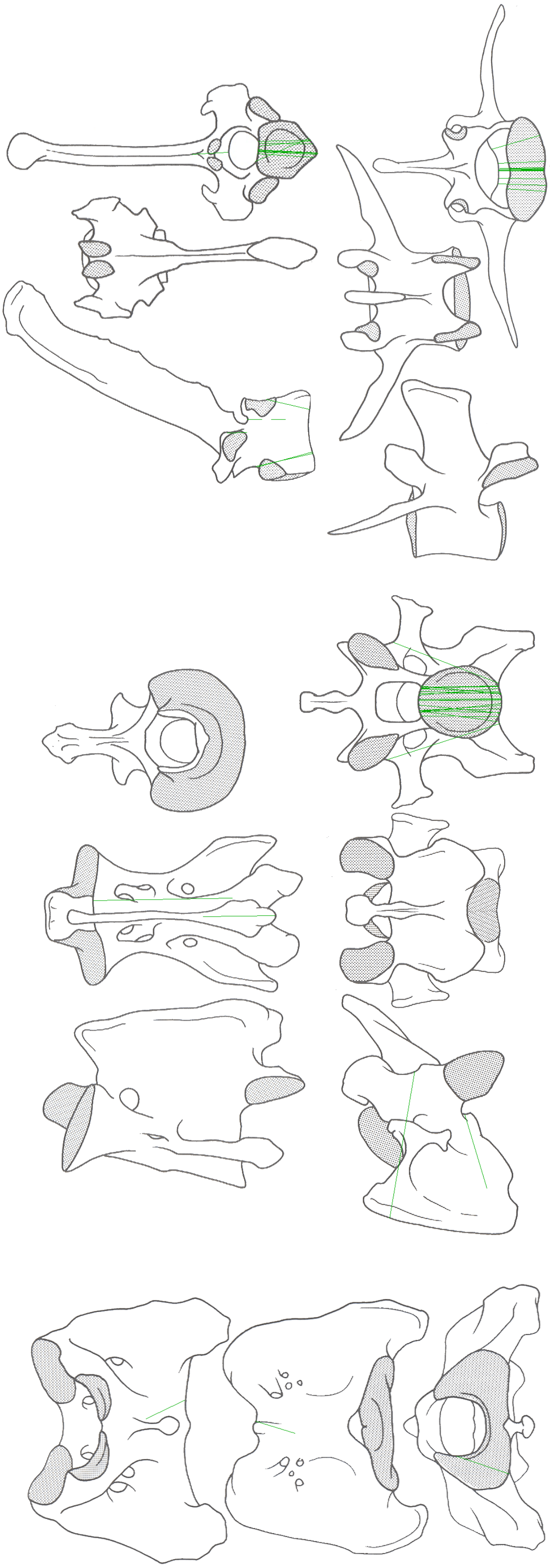


FIGURE 5.23: North Quarter phase 9 medium mammal vertebrae butchery.
Key: green - chop

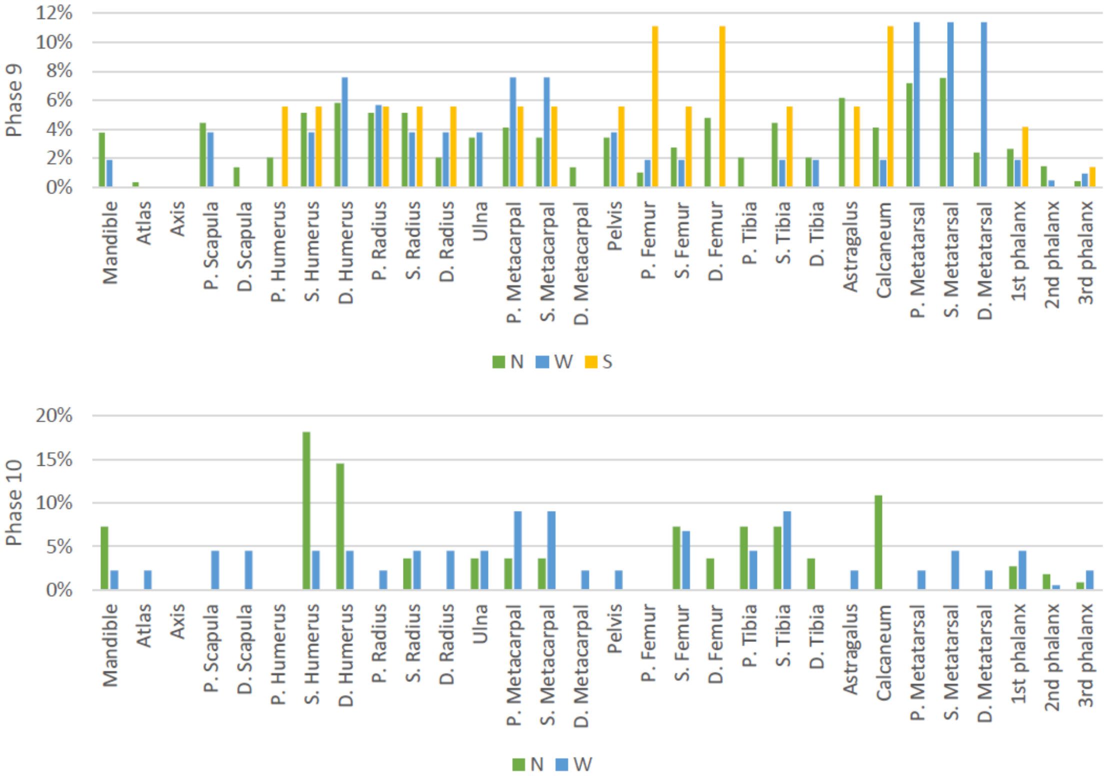


FIGURE 5.24: Cattle skeletal part abundances by phase and quarter.

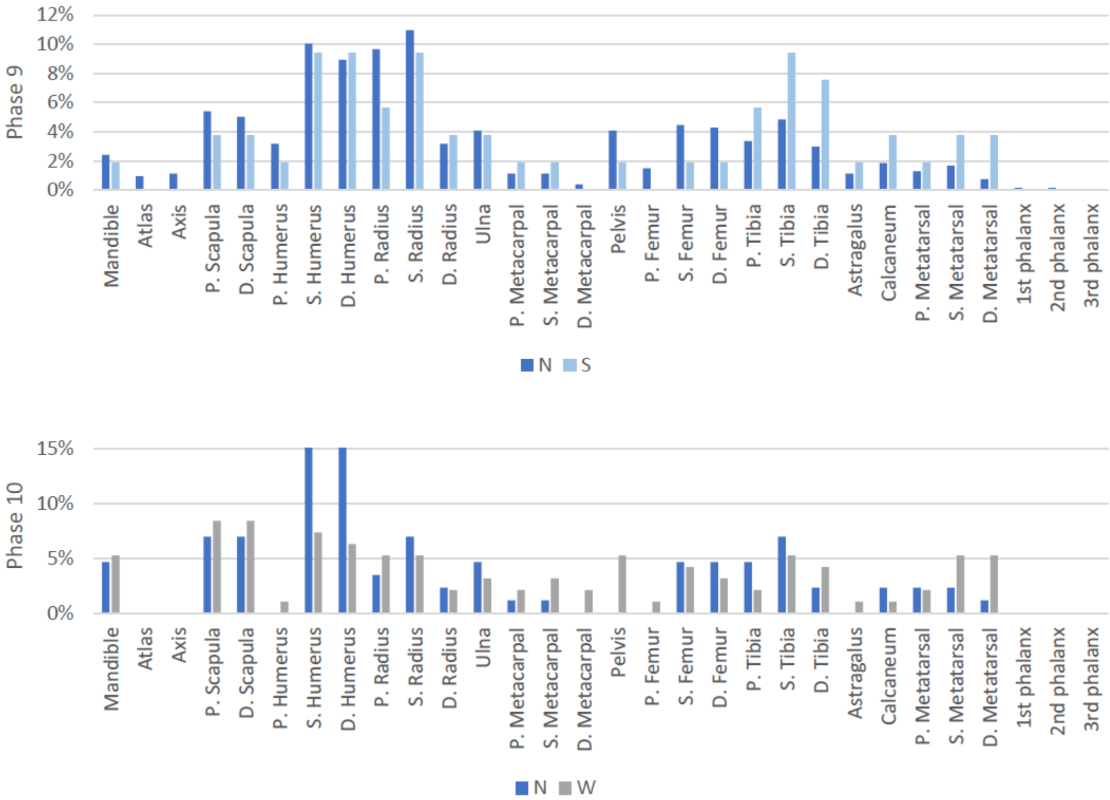


FIGURE 5.25: Caprine skeletal part abundances by phase and quarter.

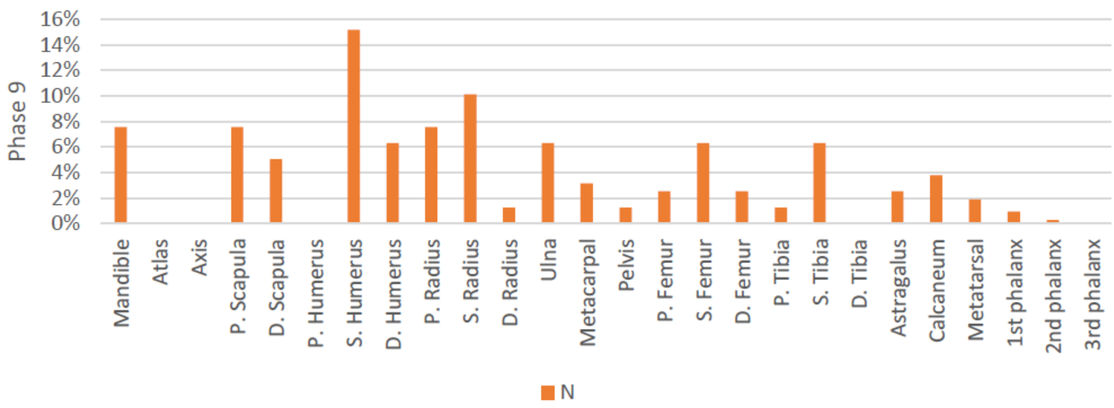


FIGURE 5.26: Pig skeletal part abundances by phase and quarter.

them on site. On the other hand, at St. Nicholas Priory, a Tudor manor house located in the West Quarter, it is the upper limb bones of both the front and hind quarters that are the most frequent from cattle, and for caprines it is once again the upper limb bones from the front quarter that are represented in the highest numbers (Levitan 1989, Table 8). Overall, this indicates that caprines were distributed and possibly consumed in a smiliar manner thorughout Exeter and its surroundings, whereas cattle consumption and butchery was highly variable between sites and areas. Some comparative data are available from Lincoln, and the patterns for cattle and caprines appear to be almost identical to central Exeter and the cattle material was also interpreted to be dressed carcasses with the primary butchery happening elsewhere, but it is unclear whether the skeletal representation is as variable (Dobney et al. 1995). If this is indeed the emergence of a consumer demand for specific cuts of meat, then it only applies to caprines while cattle were still being distributed as half carcasses or maybe whole ones in some cases.

The post-medieval butchery and skeletal part abundances show a continuation and development of the pattern that emerges in late medieval times (phase 8) as highly systematic butchery and a clear preference for upper front limb elements. This was matched by sagittal splitting of both large and medium sized mammals, which appeared to be common practice in this period. The growing differences in skeletal representation of cattle and caprines indicate that cattle, at least in phase 9, were brought into the various quarters of the city as whole animals and distributied as complete or half carcasses and then divided into smaller joints on a household level which accounts for the obvious variation in butchery mark locations. Caprines, on the other hand, were divided into smaller portions by professional butchers at an unknown location and, in particular, the upper limb bones of the front quarter were distributed across the city. While the evidence is minimal, there are indications that cattle were treated in a similar way as caprines in phase 10.

5.5 Summary

Throughout the Roman, medieval, and post-medieval periods, the three main livestock species, cattle, caprines, and pig, all saw change in butchery methods, skeletal representation, and distribution, some more so than others. At all times the animals were brought into or were present in the city as live animals before butchery. There is probable evidence of a Roman holding area for livestock in the *basilica* area (Bidwell 1979) and reconstructions and illustrations of medieval and post-medieval Exeter suggest that there may have been space within the city walls or on the urban edge to hold livestock that would later be brought in for slaughter. In the Roman period, the cattle butchery was highly systematic, and the same patterns can be seen both in Exeter and other urban settlements in England attesting to the systematic training and organisation of professional butchers in the Roman Empire. After the end of the Roman occupation, the early parts of the medieval period saw a very different pattern of livestock butchery and individual characteristics of the quarters of Exeter became apparent. The cattle butchery becomes rather haphazard compared to the Roman techniques, though there is not enough evidence to determine if it was the same case for caprines and pigs. The skeletal part abundances show that the high-status population of the North Quarter and the ecclesiastics of the West Quarter had very similar diets in terms of joints of meat, whereas the South Quarter appears to have had much higher proportions of primary butchery waste and was therefore likely to be the area where the professional butchers operated. From the beginning of the Roman settlement to the end of the 18^{th} century, it is clear that each of the species was treated differently in terms of butchery and distribution of the various parts of carcasses, though no more so than in phase 9. Despite the consistent use of sagittal splitting, all other butchery of cattle was inconsistent and, as the skeletal abundances show that they are primarily distributed as whole or half carcasses, there is a strong indication that most of the division into smaller joints happened at a household level. Caprines, on the other hand, were butchered in a systematic manner and upper front limbs of mutton or beef were clearly available as separate joints of meat.

Chapter 6

Fractures and surface modification

6.1 Introduction

Meat is not the only foodstuff that can be exploited from animals. While less common in the 21^{st} century, marrow was frequently extracted from bones in the past as it is an excellent source of fat. Through the study of fracture patterns in bones, we can determine how frequently this was done. In Maltby's (1979) study of Exeter faunal material, he notes the presence of fresh fractures in relation to each of the major livestock species and in particular for all major meat bearing cattle bones. This chapter aims to expand upon the details of his findings and quantify the number of bones that were fractured for marrow extraction.

While the presence of fresh fractures is frequently noted in faunal analyses, quantifying fracture patterns is not standard practice in zooarchaeology, and fracture history profiles have not been applied to historic faunal material prior to this study, so the comparative material is minimal, as will be apparent below. Fragmentation analysis has been included here because marrow has, at all times, been an important source of fat in the everyday diet, though the exploitation of it has largely been ignored in historic times in favour of more detailed studies of herd structures and which species are favoured for the dinner tables.

Unlike fracture patterns, recording taphonomic evidence is standard practice, though the information is infrequently included in final reports and papers. For this thesis, some caveats have been set in the interpretation of the taphonomy data. The soil conditions

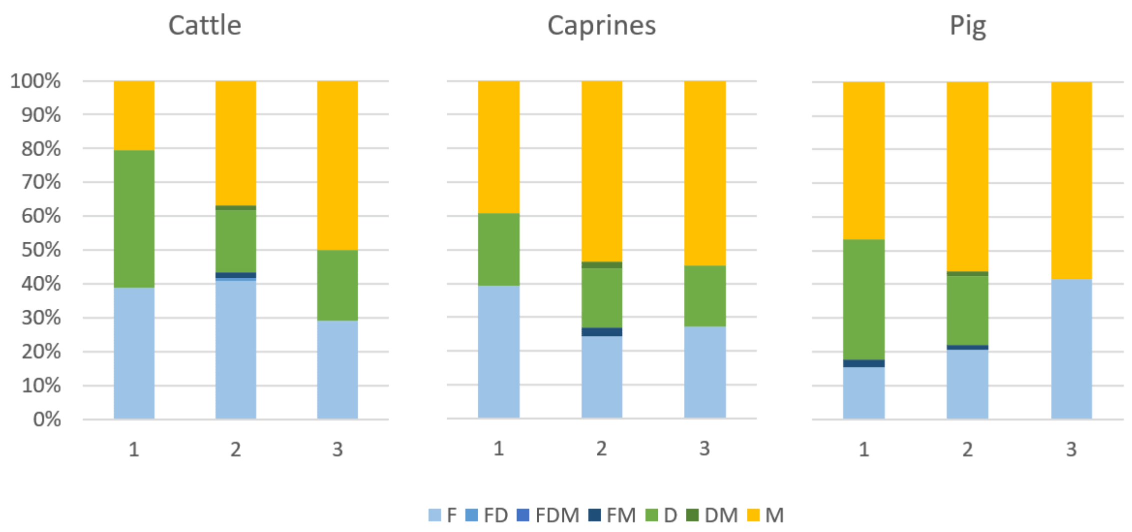


FIGURE 6.1: Fracture history profiles by species and phase

within the Roman Wall appear to be fairly uniform, so here, changes in surface weathering have been interpreted as being related to exposure time of the bones prior to deposition. The surface colouring of the bones is fairly uniform throughout all periods with few exceptions. One of the outliers are the phase 10 remains from Mermaid Yard, where the bones have been heavily bronze stained which has resulted in exceptional preservation, and the only other outlier is the extramural Haven Banks where the soils were clearly waterlogged.

6.2 Roman

The fracture history profiles for cattle, caprines, and pigs are presented below. When the data are not divided by species, the proportion of freshly fractured bones remain fairly steady between 28% and 35%; however, looking at Figure 6.1, it is clear that the proportion of specimens fractured when fresh (F), dry (D), and mineralised (M) varies between species and phases. Overall, cattle specimens sustained fresh fractures most frequently, followed by caprines and lastly pig, though caprines were as frequently exploited for marrow as cattle during the Roman military phase (phase 1), while cattle dominated during the Roman Civil occupation (phase 2), and pigs at the end of the Roman occupation and in the post-Roman times (phase 3). The phase 3 sample size is very small, so it may not be representative of the whole phase, though it is interesting if there was

FIGURE 6.2: Axially split bones from context 787 at Friernhay Street

a shift towards pig marrow extraction around the end of the Roman period as it reflects a clear shift in species exploitation from phase 2. Additionally, the faunal material from the Deanery only sustained fresh fractures in 10% of all specimens (Figure 4.20), suggesting that the exploitation patterns were very different between living quarters and public building areas.

The typical way of extracting marrow is to place a blow to the shaft of a long bone; however, the Romans used a different technique sometimes described as axial splitting which fractures the bone from the epiphysis and send radiating spiral fractures up the shaft. This method of fracturing is unusual as the spongy ends of long bones are designed to absorb shock and are therefore more difficult to fracture when the bone is fresh, hence why the shaft is normally the target. How the Romans did it is unknown. As seen in Chapter 5, there are chops on the distal ends of limb bones, but none of the chops or other tool marks are related specifically to the fractures. This fracture type has been identified in large numbers on cattle humeri, radii, and tibiae, though also occuring frequently on femora and sometimes on astragali. Metapodia often exhibit fresh fractures too, though these originate on the shaft, which was also noted by Maltby (1979). Based on the location of the axial splits and the lack of tool marks associated with the fractures themselves, the most likely method used was to take a chisel-like tool, soft enough to not leave marks on the bones, insert it in an articulated joint, and strike a blow to the end of the tool, creating enough force to travel through the epiphyses of both bones and fracture the shafts. It is possible that the bones were not articulated when they were fractured, though all the evidence points towards them still being joined, based on the location of the fractures and the elements they are located on. For the front limb, the evidence is particularly strong as chops through the back of the ulna (Figure 5.4) indicate how the joint was exposed to allow for the fracturing of the humerus and radius.

Axially split bones were not specifically recorded for this study, so quantifying the number of specimens it has been identified on is difficult, but a simple calculation shows that fresh fractures occur on 69% of all cattle humeri, radii, femora, and tibiae and the vast majority of these fractures are axial splits. In some contexts, they are particularly numerous suggesting a systematic marrow extraction process in areas of Roman Exeter. Notably, in Friernhay Street context 787 a considerable number was recovered (Figure 6.2), none of which could be refitted, meaning that a corresponding number was present at the time. It is clear that some of the fractures did not expose the marrow, particular on proximal radii, though most fracture attempts were successful. The majority do not have completely fresh fractures, so some drying must have happened prior to marrow extraction. Unfortunately, this context had been exposed to heat after the fractures occurred, which is evident in the brown colour of the bones, so it is possible that they were cooked or heated first, though it seems highly unlikely. Axial splitting as a means of marrow extraction appears to be typical of the Roman period and has been recorded in several other sites. In a review of carcass processing in Roman Britain, Maltby (2007) lists axial splitting as one of the distinctive types of processing found in major urban sites though the frequency varies greatly between 11% and 78% and, similar to context 787 in Exeter, they are often found in discrete contexts suggesting that they were accumulated in large numbers for secondary processing (Maltby 2007). Like the consistency in butchery patterns, the occurrence of this fragmentation method once again demonstrates that there were

TABLE 6.1: Taphonomy absolute counts and frequencies by phase

Type	1	2	3
Carnivore gnawing	7	146	9
Staining	1	3	-
Burning – singed	39	126	12
Burning – charred	2	15	-
Burning – calcined	-	1	-
Carnivore gnawing	1.8%	7.0%	6%
Burning - all	10.3%	6.8%	8%
Weathering score average	2.3	1.7	1

uniform ways of processing cattle, and probably caprines and pigs, in urban Romano-British sites attesting to the connections between these settlements and the people that lived in them.

The recorded taphonomy in Exeter shows that there were both variation and continuity in occurrences of certain types over time (Table 6.1). The frequency of total number of specimens that have been exposed to heat only shows small variations between the three phases, indicating that the use of fire in cooking and burning waste remained fairly stable throughout, and possibly after, the Roman occupation. This also suggest that heat exposure is not related to the frequency of dry fractures (Figure 6.1). The frequency of carnivore gnawing increases over time, starting with 1.8% in the Roman military phase and growing to 7% in phase 2 with a slight decrease to 6% in phase 3. It indicates that dogs were much less common in the Roman military but were brought to Exeter in larger numbers with the new population that moved in after the settlement gains civil status, or alternatively, that dogs were allowed to roam more freely in the civil settlement. The rate of gnawed bones in the military phase corresponds to that found in the Roman deposits at the General Accident site in York (O'Connor 1988), though no increase is seen over time suggesting that the number of carnivores present in Roman urban settlements was not as uniform as most other Roman trends. The weathering scores also suggest that changes occurred with new settlement status and continued into the 4^{th} century and after the departure of the Romans. The noticeable decrease in average weathering score suggests a difference in waste disposal methods, with the bones being exposed for considerably longer in phase 1, whereas they were probably buried quickly after consumption in phase 3. The low score for phase 3 is likely to be related to the lower amount of

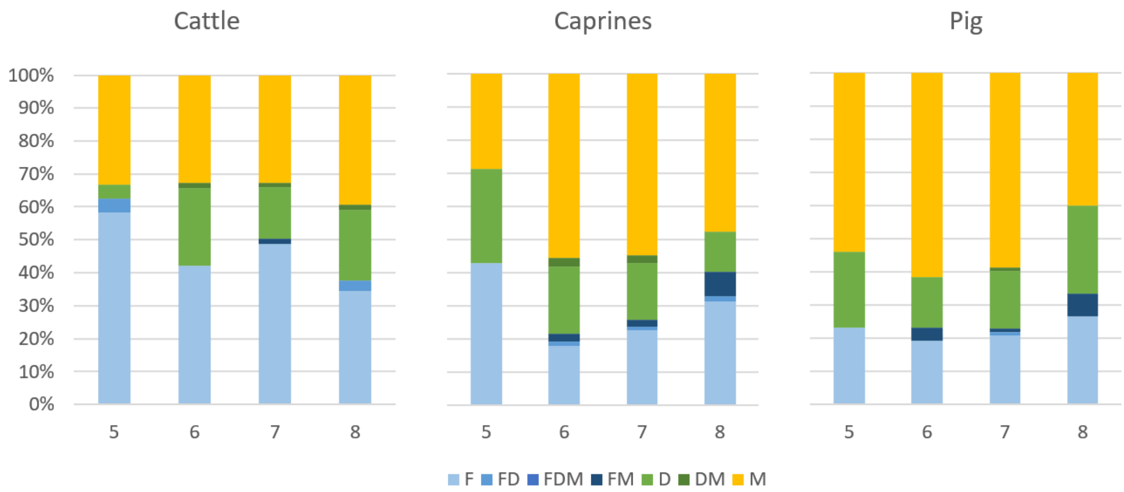


FIGURE 6.3: Fracture history profiles by species and phase from the North Quarter

dry fractures compared to the previous two phases (Figure 6.1), though the increasing amount of mineralised fractures in this phase indicates that the bones were more likely to be broken post-deposition than in phase 1 and 2, despite the quick burial. Due to the lack of comparative analyses, it is not possible to determine if similar patterns are present in other contemporary urban settlements.

6.3 Medieval

The variations in fracture patterns are much more apparent for the species in the medieval period compared to the Roman period, and there are clear differences between the quarters where the data are available (Figure 6.3, 6.4, and 6.5). Very few data for pig were gathered from phase 8 in the North and West Quarters and phase 5 in the North Quarter, so in these instances they should be used with caution. The figures from the North Quarter indicate that fracturing bones when fresh was a much more common practice in phase 5 (AD 900-1050) than in the Roman period and in any of the later medieval phases following the Norman Conquest, though it not possible to say if the same pattern was present in the other quarters. In all phases in the North Quarter, cattle were the most heavily exploited for marrow, and caprines and pig had similar frequencies in phase 6, 7, and 8 with a steady increase in frequencies over time.

In the West Quarter, the patterns are completely different. In phase 6 and 7, caprines and cattle have similar proportions of freshly fractured specimens, but the proportion decreases for cattle in phase 8 while it remains the same for caprines. In phase 6 and 7 only very small amounts of pig specimens have been broken for marrow but this increases to approximately 25% in phase 8. Moving to phase 7 in the South Quarter, cattle are once again the most frequently exploited. The medieval fragmentation patterns show that marrow extraction is specific to species and rather heavily influenced by social context. Assuming that the North Quarter sets a baseline for high-status living in medieval Exeter, it underlines a big difference between the high-status diets and that of the ecclesiastics in the phase 6 and 7 West Quarter. The North Quarter population consumed marrow, particularly from cattle, in much larger quantities than in the West Quarter, which shows more of a preference for caprines and almost entirely avoids pig. To test that this trend is not a result of low quantity of specimens being fractured in one Quarter compared to the other, Morland's (1994) %Completeness method was used to assess the pig fragmentation levels (Figure 6.5). The results show that very similar quantities of bones are being fractured in both the North and West Quarters, it was the cause and timing of fracturing that varies rather than the overall level of fragmentation, i.e. if fragmentation levels are constant, but a higher proportion of fractures are of fresh bone, that likely indicates higher levels of bone marrow exploitation or other peri-mortem processing. This confirms the trends in Figure 6.4 showing that the ecclesiastic population exploited very little pig marrow compared to the high-status households.

While the West Quarter material represents high-status living in phase 8, there is clearly still a difference from the North Quarter as cattle is now the least exploited while pig increases, though not to the same levels as in the North. Interestingly, the South Quarter, which is primarily industrial and craft based, exhibits a combination of the patterns from the two other quarters. The cattle are fractured for marrow as frequently as in the North Quarter, while for caprines, it is the same as in the West Quarter. This could be indicative of marrow extraction not being associated with status, or that there were similar practices in place as in the Roman period where marrow processing occurred in certain

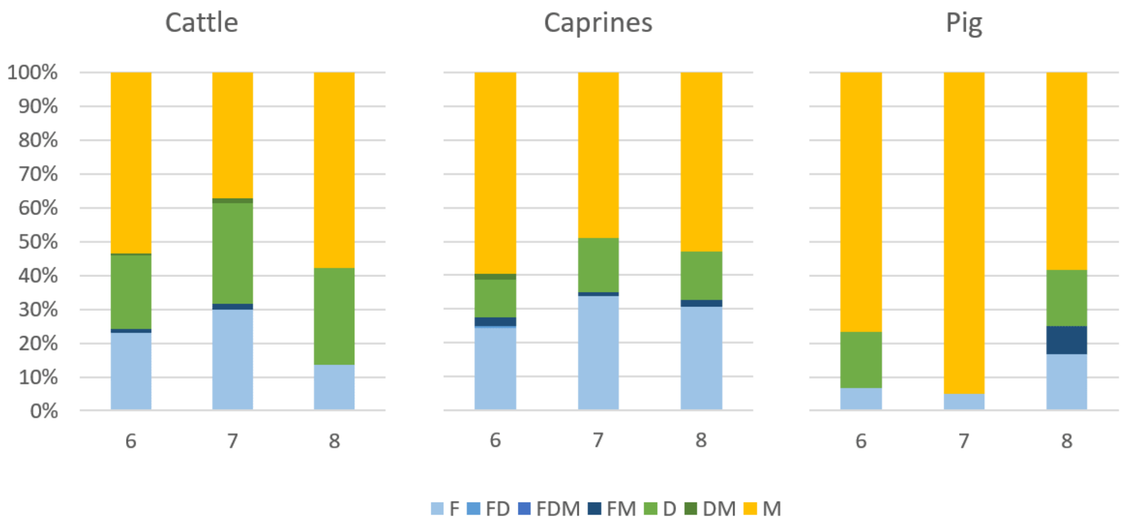


FIGURE 6.4: Fracture history profiles by species and phase from the West Quarter

areas and was not household based, though no deposits containing unusually high numbers of marrow bones have been identified, so it is more likely to have been related to social practices in the various quarters.

Rates of carnivore gnawing and burning vary noticeably between phases and quarters (Table 6.2, 6.3, and 6.4). The proportion of gnawed bones in the medieval period ranges from 1.1% in phase 6 in the West Quarter to 10.4% in phase 5 in the North Quarter. As the surface weathering scores suggest minimal differences in waste disposal exposure times, the variation in gnawing proportions must mean that the number of roaming dogs varied greatly between the different areas of the city and that their access to waste material varied as well. Though, if surface weathering is not a reliable indicator of exposure time, a high frequency of gnawed bones is often interpreted as a long exposure time. Dogs can also create fresh fractures, so the exceptionally high proportion of gnawing in phase 5 in the North Quarter may very well be related to the similarly high number of freshly fractured bones (Figure 6.3). At all times, the North Quarter has a considerably higher proportion of specimens with gnawing than the corresponding phases in the West Quarter, showing that dogs were much more common in the high-status households or had greater access to garbage than in the monasteries, though the numbers appear to decrease in phase 8.

During phase 7, the highest proportion of gnawing is in the South Quarter, which

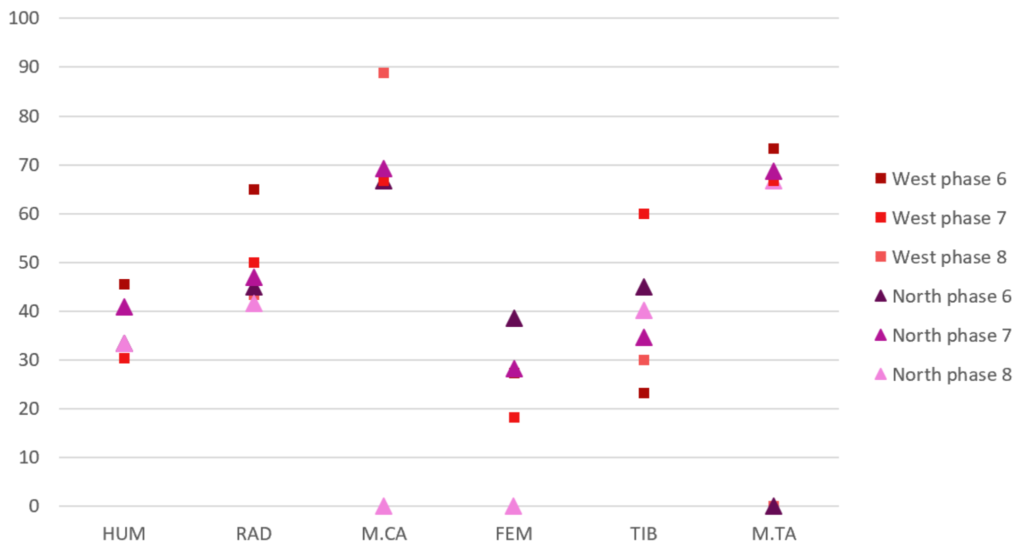


FIGURE 6.5: %Completeness of pig specimens from phase 6, 7, and 8 in the North and West Quarters. X-axis shows completeness in % and y-axis lists element type. No data were available for some phases and elements, these are shown as 0% complete

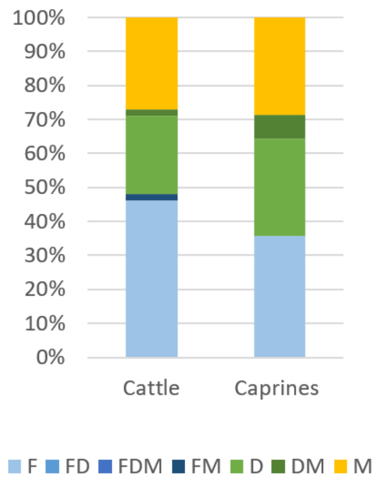


FIGURE 6.6: Fracture history profiles by species and phase from the South Quarter

TABLE 6.2: Taphonomy absolute counts and frequencies by phase from the North Quarter

Type	5	6	7	8
Carnivore gnawing	14	16	101	9
Rodent Gnawing	-	1	1	3
Insect damage	-	-	2	1
Burning – singed	57	36	163	37
Burning – charred	8	14	79	5
Burning – calcined	4	-	3	-
Carnivore gnawing	10.4%	3.8%	5.5%	2.3%
Burning - all	51.4%	11.7%	13.3%	10.9%
Weathering score average	1.9	1.7	1.7	2

TABLE 6.3: Taphonomy absolute counts and frequencies by phase from the West Quarter

Type	6	7	8
Carnivore gnawing	7	14	5
Digested	1	-	-
Burning – singed	-	6	80
Burning – charred	19	2	6
Carnivore gnawing	1.4%	2.9%	1.1%
Burning - all	3.3%	1.6%	18.2%
Weathering score average	2.1	2.1	2

TABLE 6.4: Taphonomy absolute counts and frequencies by phase from the South Quarter

Type	7
Carnivore gnawing	17
Staining	8
Burning – singed	22
Burning – charred	1
Carnivore gnawing	7.9%
Burning - all	10.7%
Weathering score average	1.25

could be caused by roaming dogs being attracted by the waste from the butchers operating in the area. The low weathering score for the South Quarter may be caused by quicker disposal of industrial waste material, though close proximity to the river may have resulted in some water-logged deposits which would increase preservation. At Coppergate in Anglo-Scandinavian York, the gnawing proportions range between 1% and 6% with a few outliers above and below these amounts (O'Connor 1989, Fig. 23). The variation between areas has been interpreted as varying waste exposure times which, in turn, may indicate less pressure on living space or a greater tolerance for unclean living (O'Connor 1989). The same may very well be true for Exeter. Similar to gnawing, the levels of burnt bones vary greatly between 1.6% and 51.4% with the highest proportions occurring in the North Quarter in phase 5, 6, and 7 and the lowest in the West Quarter in phase 6 and 7, with the South Quarter ranging in between the two other areas. During phase 8, the patterns shift, and the West Quarter has the highest proportion with 18.2% and the North and South Quarters have the lowest at 10.9% and 10.7%. As mentioned in Chapter 4, the amount of burnt bones is primarily determined by the individual contexts rather than overall patterns, though the scale of the differences in the first three phases suggests that bones were much more likely to be exposed to heat in a high-status household and in industrial contexts than in a monastery. The drastic increase in heat damaged bones from phase 7 to 8 in the West Quarter corresponds to the change in social status from ecclesiastic to high-status in this area, which further underlines the differences in use of heat in the two population groups. It is unlikely to mean that the ecclesiastics did not eat cooked meat, but rather that cooking methods did not expose the bones to direct heat; for example, boiling or salt and smoke curing meat do not leave heat traces on the bones, whereas roasting does.

6.4 Post-medieval

The majority of all post-medieval faunal material is from phase 9 in the North Quarter, with only small amounts available from elsewhere, though it should be interpreted with caution as it may not be representative of the overall patterns for this phase. Figure 6.7, 6.8, and 6.9 show the post-medieval fracture history profiles. In phase 9, 40-45% of all

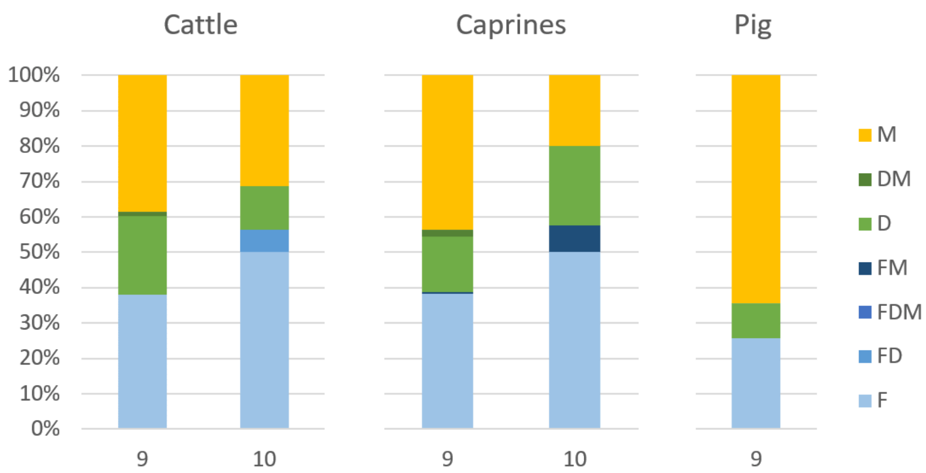


FIGURE 6.7: Fracture history profiles by species and phase from the North Quarter

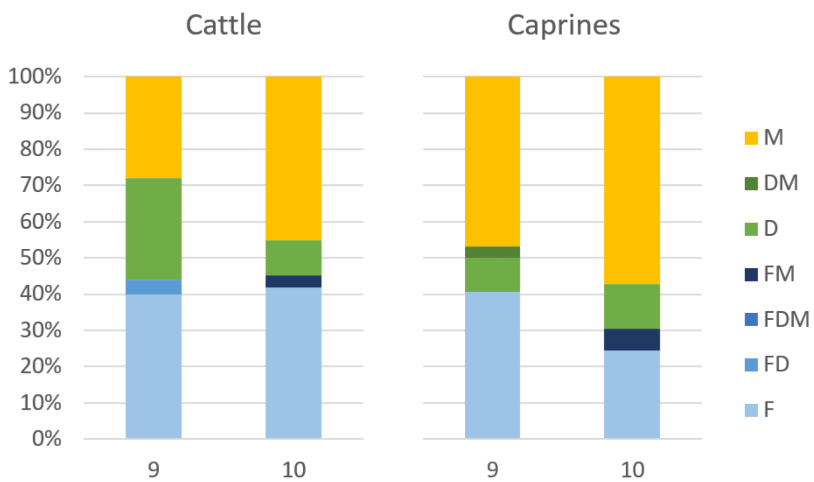


FIGURE 6.8: Fracture history profiles by species and phase from the West Quarter

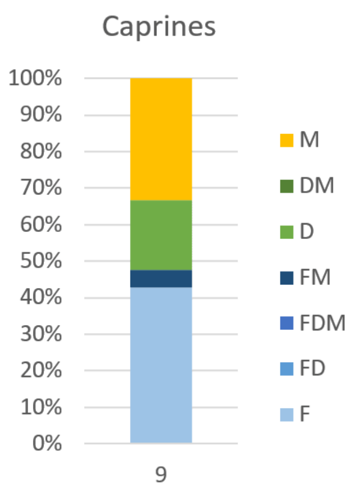


FIGURE 6.9: Fracture history profiles by species and phase from the South Quarter

cattle and caprine bones are fractured when fresh, while the proportion is lower for pig at 25%. In phase 10 the frequencies are more variable. In the North Quarter, 55% of cattle and caprine specimens exhibit fresh fractures while in the West Quarter it is 45% of cattle and 30% of caprines. Overall this suggests that in phase 9 fresh fractures occur in almost equal proportions for both cattle and caprines in the quarters where data are available, though in phase 10, there is a divide between the North and West Quarters, with marrow extraction being much more frequent in the North Quarter. This difference may be caused by variations in the skeletal representation (Figure 5.24) as the material from the North Quarter is primarily food waste while in the West Quarter it is mainly butchery waste which may be less likely to be fractured for marrow.

The post-medieval surface modifications show a continuation of both gnawing and burn proportions between phase 9 and 10 in the North Quarter with the gnawing being similar to phase 8, though there is a drastic reduction in signs of heat damage (Table 6.5). The West Quarter continues to have the lowest proportion of recorded carnivore gnawing, though the amount increases to similar levels as the North Quarter in phase 10. Meanwhile, the amount of burnt bones has been drastically reduced since the Late Medieval period and continues to decrease throughout the post-medieval period. The South Quarter is noticeably different from the other two with a high proportion of both gnawing and burnt bones, similar to phase 7, though with an increase in burning unlike in the other quarters. This data show that the South Quarter was the outlier in the post-medieval period despite this area being no different to the rest of central Exeter according to the structual evidence found during the excavations as well as the skeletal part abundances, butchery evidence, fragmentations patterns, and the excavation notes, so it may simply be a result of limited faunal material, continued use of Late medieval cooking methods or burning of waste, and this area having more dogs than the rest of Exeter.

6.5 Summary

Fresh fractures are not always synonymous with marrow extraction, though they are very closely related, and the high levels of these fractures throughout all phases and quarters in Exeter show that marrow was at all times an important component of the

TABLE 6.5: Taphonomy absolute counts and frequencies by phase and quarter

	North		South	West	
Type	**9**	**10**	**9**	**9**	**10**
Carnivore gnawing	41	4	8	1	4
Rodent gnawing	3	1	-	3	-
Digested	1	-	-	-	-
Insect damage	1	-	-	-	-
Staining	3	27	72	-	-
Burning – singed	10	2	14	2	1
Burning – charred	13	-	2	1	-
Burning – calcined	3	-	-	-	-
Carnivore gnawing	2.7%	2.6%	8%	0.7%	2.1%
Burning - all	1.7%	1.3%	16%	2.2%	0.5%
Weathering score average	1.7	1.7	1.9	2.0	2.0

urban diet and may even have been exploited on an industrial level in the Roman period. The preference for marrow from the separate livestock species varied with site status and phase, but overall, cattle was the most frequently exploited and pig the least.

Gnawing and burning varied even more so with site function and phase than the fragmentation patterns, indicating of how cooking methods, waste disposal, and number of roaming dogs varied through time. There is no direct association between site function, status, and the amount of gnawing and burning. Nonetheless, a high proportion of gnawing and burning is only seen in 'industrial'/craft based contexts of the South Quarter, whereas gnawing occurs in fairly even proportions in the high status material from the North and West Quarters, with burning being more frequent in the former than in the latter.

Chapter 7

Livestock Management

7.1 Introduction

The previous two chapters have focussed on the dead animal by studying the way carcasses are divided up and distributed (chapter 5) and what happens to the bones themselves in terms of marrow extraction and taphonomic agents (chapter 6). In this chapter, we will look at livestock exploitation, and thereby the live animals, and the management and development of herds. The management of herds is studied by looking at age-at-death indicators such as epiphyseal fusion and the eruption and wear of teeth which can in turn indicate whether the animals were managed for meat, milk, wool, or traction. Sex has been included as it can provide further insight into herd structures, though minimal evidence could be gathered on the subject and it is therefore not a major component of this study.

The fusion graphs for cattle, caprines, and pig presented in this chapter have been interpreted using Payne's paper on sheep and goat kill-off patterns (Payne 1973, Figure 1, 2, and 3). Payne created three optimal models for the management of animals kept for respectively meat, milk, and wool. The study indicates that in a herd managed purely for meat the main slaughter will happen, particularly of males, when they reach their adult size but not any longer as they will consume fodder without increasing further in size. For sheep the optimal slaughter age is between 18 and 30 months old which is equivalent to fusion stage 3 in this study (see Table 3.2), for cattle it will also be during stage 3 they reach adult size, though pigs grow faster, so it will likely happen before stage 3. For specialised milk management almost all males are slaughtered shortly after birth while all females are kept. In the archaeological record this would be visible as almost 50% of the herd being culled before stage 2 regardless of the species. When a herd is reared for wool very few animals will be culled as both males and females produce fleeces meaning that the fusion graph will show almost all animals being kept past full skeletal maturity. The same pattern is visible for cattle being used for traction, though will not be applicable to pigs as they do not have fleeces or can be used as working animals.

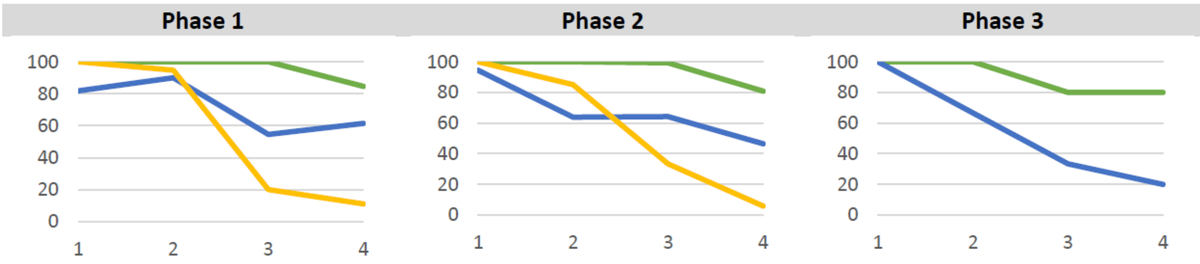
In reality, herds are rarely managed purely for one purpose but rather a combination of two or more products to get good use out of as many animals as possible. For example, milk and meat management strategies are easily combined as the farmer can keep the majority of the young males otherwise culled in a pure milk herd to a slightly older age and then sell them for meat. To make matters more complicated, new studies show that models for mortality profiles appear to be statistically similar (Marom and Bar-Oz 2009, also Brochier 2013; Discamps and Costamagno 2015), so in the future assessments of culling profiles may prove to be invalid, but they have been included here as they are still our best way of assessing herd management strategies in spite of the complicated interpretations.

Metric analysis of bones has been used here in an attempt to understand how humans have affected the size and shape of cattle, caprines, and pigs in Exeter by the introduction of new stock from other areas or by the deliberate improvement of existing local herds though selective breeding. Rather than employing similar methods to Maltby and Levitan in their studies of faunal material, the use of log-ratios following the method described in Meadow (1999) has been chosen to further our existing understanding of livestock improvement in this area.

7.2 Roman

The kill-off patterns based on bone fusion in Table 7.1 show variation in the management of caprines between the Roman military (phase 1) and civil phases (phase 2). Fusion graphs show the lifespan of a herd, with 100% of the animals being alive at fusion stage 1 (except for neonatal deaths). The following stages then show the proportion of the herd still alive at each stage, until, in theory, there should be 0% left. In reality we can only

TABLE 7.1: Kill-off patterns based on fusion for Roman cattle, caprines and pig. Key: green – cattle, blue – caprines, yellow - pig



assess the first 3-4 years (dependent on species) of the herds' life, which is the age where they reach full skeletal maturity (this is stage 4 in the graphs), tooth wear is then needed to understand the management of old animals.

Based on the fusion graphs/kill-off patterns, cattle were retained to full adulthood in both phases, suggesting that they were used as working animals. Pigs show the typical 'meat' pattern of early killing with only a small proportion kept into adulthood; these older animals were likely breeding sows and boars. There are some slight problems with the caprine data from phase 1, which can be seen as animals 'coming back to life', though this is most likely a result of the small data set and the stage 4 value lies within the confidence interval for stage 3 (chi-squared test: $p = 0.69$). Despite this confusion in the data, the patterns show that over 50% of all animals were kept until skeletal maturity in both phases, though young animals are managed in two different ways. There are neonatal deaths in both phases, and in the military phase there are no further deaths until fusion stage 2, after which the graph levels out. This pattern indicates a mixed management for either milk or meat alongside wool. The majority of the slaughter happens during fusion stage 2 in the Roman civil phase, once again suggesting a mixed management for milk and wool, but using a different management system than during the military phase. The age-at-death evidence from phase 3 is minimal, and chi-squared tests of the cattle or caprine data show that none of the changes seen in Table 7.1 are statistically significant.

The dental wear data are in overall agreement with the fusion data from cattle while they suggests that a higher proportion of pigs were kept to an older age (Table 7.2, 7.3, 7.4). As there are few reasons aside from breeding to keep pigs into older age, the discrepancies in fusion and dental ages may be a result of differential deposition of old and

TABLE 7.2: Cattle tooth wear and eruption as absolute counts from Roman phases

Wear Stage	1	2	3
A	-	-	-
B	-	-	-
C	-	-	-
D	-	3	-
E	3	3	-
F	-	4	-
G	6	9	1
H	4	2	1
I	-	2	-

TABLE 7.3: Caprine tooth wear and eruption as absolute counts from Roman phases

Wear Stage	1	2	3
A	-	-	-
B	1	1	-
C	-	1	-
D	2	9	1
E	2	11	-
F	1	6	-
G	3	3	-
H	-	-	-
I	1	-	-

TABLE 7.4: Pig tooth wear and eruption as absolute counts from Roman phases

Wear Stage	1	2	3
A1	-	-	-
A2	-	-	-
A3	-	-	-
B	1	5	-
C	-	1	-
D	-	-	-
E	1	3	-
F	-	5	-
G	-	1	-

TABLE 7.5: Absolute counts of sex for major domesticates in Roman phases

		1	2	3
Cattle	Male	-	1	-
	Female	1	1	-
Caprines	Male	-	1	-
	Female	1	1	-
Pig	Male	3	5	1
	Female	1	4	-

young animals with heads, and thereby dentition, primarily representing older animals while post-cranial elements may be coming from young animals though another possibility is discussed further below. The caprine tooth wear and eruption data from phase 1 are also in agreement with the fusion data. The data from phase 2, however, do not show any resemblance to the fusion ages. Tooth wear suggests that the main slaughter period was between 1 and 3 years (wear stage D and E) which is equivalent to fusion stage 3 and 4, meaning that, similar to pig, the tooth wear indicates older slaughter ages than fusion. This profile suggests that caprines were primarily kept for meat.

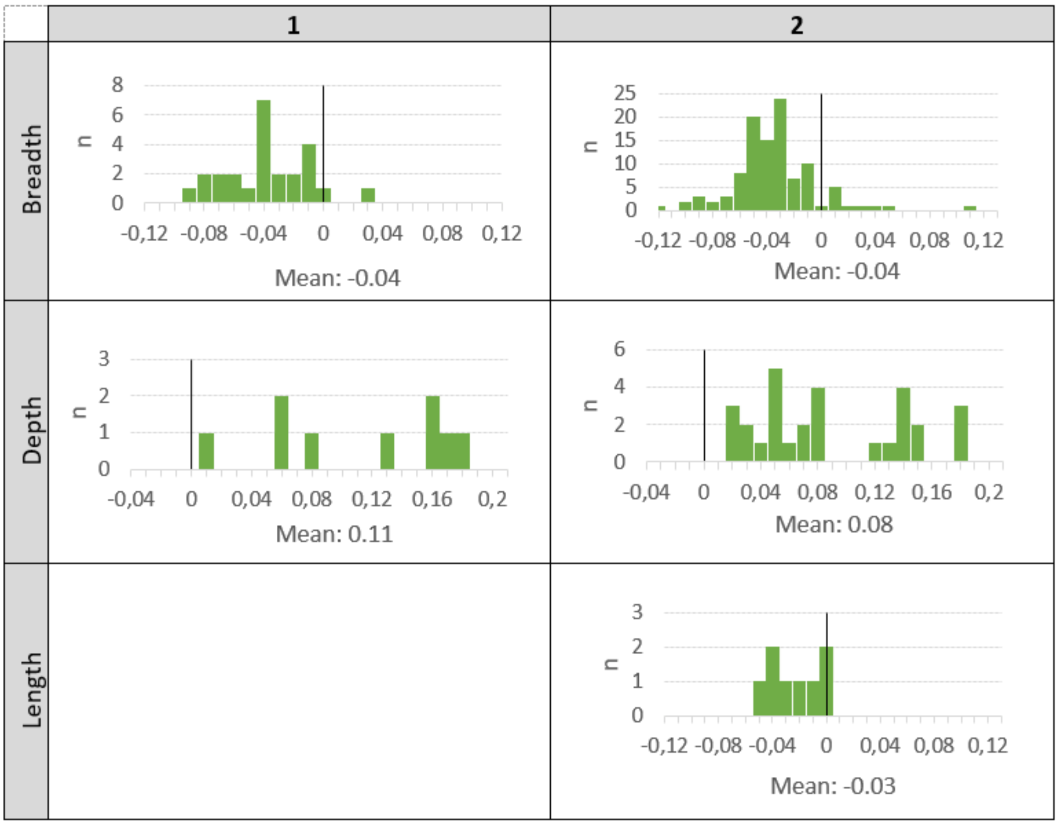
Sex ratios

Very little information on sex ratios has been recovered so it cannot shed further light on the management practices for cattle and caprines (Table 7.5). For pigs it appears that slightly more males than females have been identified, though this may be influenced by definite males being easier to identify than females as young males can look similar to females while females will never reach the size or gain the distinct features of fully adult males. When considering pigs from a meat management perspective it makes sense to keep only a few older females and one or two males for breeding while culling the remaining animals, regardless of sex, when they reach full adult size, which would result in an almost equal number of males and females to appear in the archaeological record.

Size comparison

The available metrical data from cattle, caprines and pigs are presented as log- ratios in Table 7.6, 7.7, and 7.8. The breadth log-ratios include all breadth measurements taken on proximal and distal ends of long bones; depth log-ratios include all depth measurements

TABLE 7.6: Cattle log-ratios and means from Roman phases



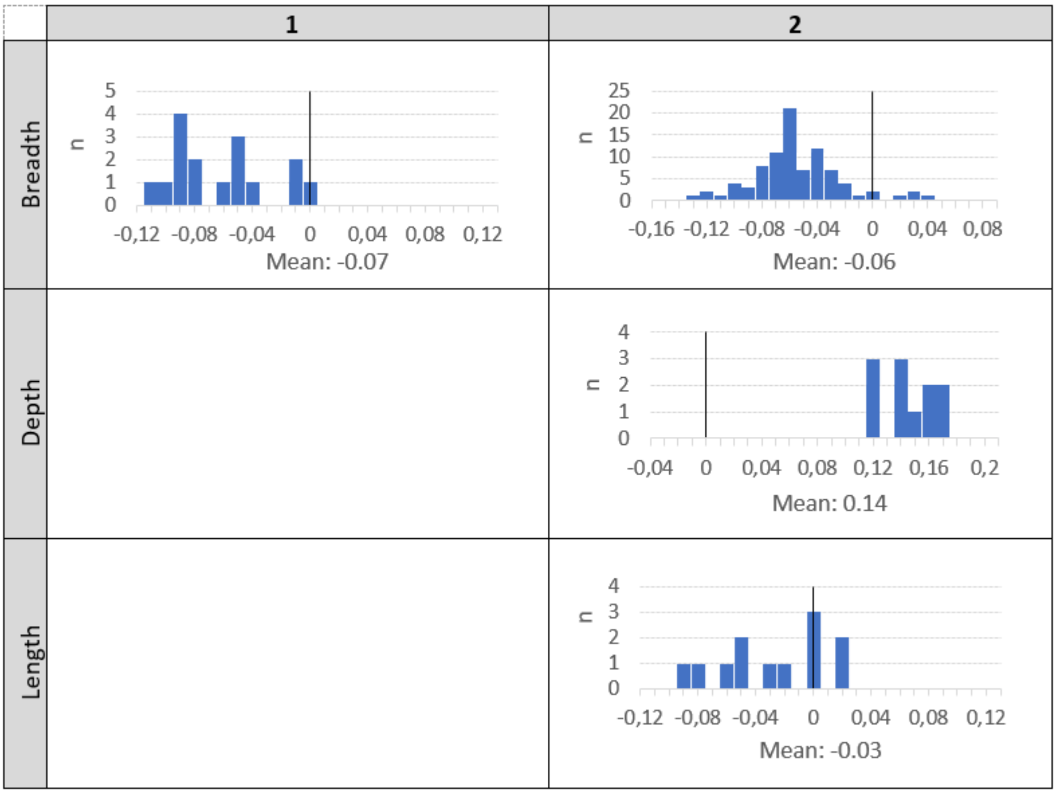
of distal metapodia; and length log-ratios include all measured greatest lengths. The data show that the various measurements of the animals were consistent between phase 1 and 2 as the minimal variations in means between the phases is a result of sample sized rather than real differences (t-test on breadth log-ratios: $p = 0.69$; depth: $p = 0.32$). Looking at the depth ratios, there appears to be groupings of smaller and larger animals which is more apparent in the phase 2 data than from phase 1 due to the smaller sample size. These groupings are likely a result of sexual dimorphism. Insufficient data were gathered from phase 3 to provide comparison.

Discussion

Maltby's fusion and tooth wear data from Roman Exeter both showed that a large number of cattle reached maturity, particularly in the early Roman period (Maltby 1979, 31, Table 57 and 59), which correlates with the data presented above. He also noted a larger number of immature animals in 4^{th} century material, suggesting a greater exploitation of cattle for meat rather than as draught and/or dairy animals as in the previous centuries. Maltby's caprine age data indicate that the main peak of slaughter happened when the animals are between 15 and 26 months old (fusion stage 3), which suggests a different pattern than seen in the fusion data above, though they do support the patterns gathered from tooth wear (Maltby 1979, 42). Additionally, he also noted that the fusion and tooth wear data show different patterns, so even when combining the new and old data, the caprine management practices are still unclear. This discrepancy may be a result of mixed husbandry practices or different herds supplying different parts of the Fortress and Roman town, though it is possible that our methods for studying age profiles are flawed and therefore giving us different results depending on whether cranial or post-cranial elements are studied. Unsurprisingly, the evidence of pig slaughter ages from Maltby's study (1979, 55) show, like in this analysis, that less than 10% of all pigs consumed in Exeter reached maturity at any point in time. Additionally, in his analyses, there were no signs of size change in cattle or caprines within the Roman period similar to the log-ratio data shown here (Maltby 1979, 36, 49). The metrical data for pigs will be discussed in section 7.4 below.

The data from Exeter show close similarity to those from other Romano-British towns. In 3rd to mid-5th century Wroxeter, tooth wear data of cattle show that they were kept in a very similar manner to Exeter, with the vast majority of animals reaching maturity suggesting that they were kept as working animals, an interpretation which is supported by associated pathological evidence (Hammon 2011, Fig. 5). Furthermore, this pattern is repeated in Roman Lincoln (Dobney et al. 1995, Table 28). The age data for caprine and pigs are more complex as dental eruption and wear once again suggest the animals are older than ages given by epiphyseal fusion. In Lincoln and elsewhere, one of the interpretations of this discrepancy is that fusion in more 'primitive' breeds, such as the ones found in the Roman period, is in some way delayed and thereby giving too low age estimates, while the dental ages may be more accurate. Based on dental wear and eruption, most pigs in Lincoln would have been kept until adulthood, though with some slaughter of juvenile and immature animals; the fusion data, on the other hand, suggest that few animals reach adulthood (Dobney et al. 1995, Table 37 and 38). This is the same

TABLE 7.7: Caprine log-ratios and means from Roman phases



pattern seen in Exeter, so it is possible that pigs were kept less intensively for meat than previously presumed. The majority of the 4^{th} century Lincoln caprines are, according to tooth wear data, kept until 1-2 years old (equivalent to fusion stage 3) with less than 20% being kept after they reach four years old whereas the fusion data suggest that 41% of all caprines survive into their 3-4 year (fusion stage 4) with the main slaughter happening after 2.5-3 years, similar to what is seen in Exeter (Dobney et al. 1995, Table 34 and 52b).

TABLE 7.8: Pig log-ratios and means from Roman phases

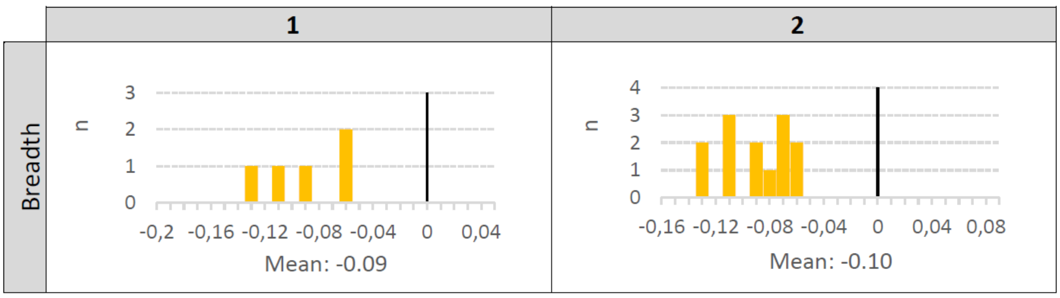
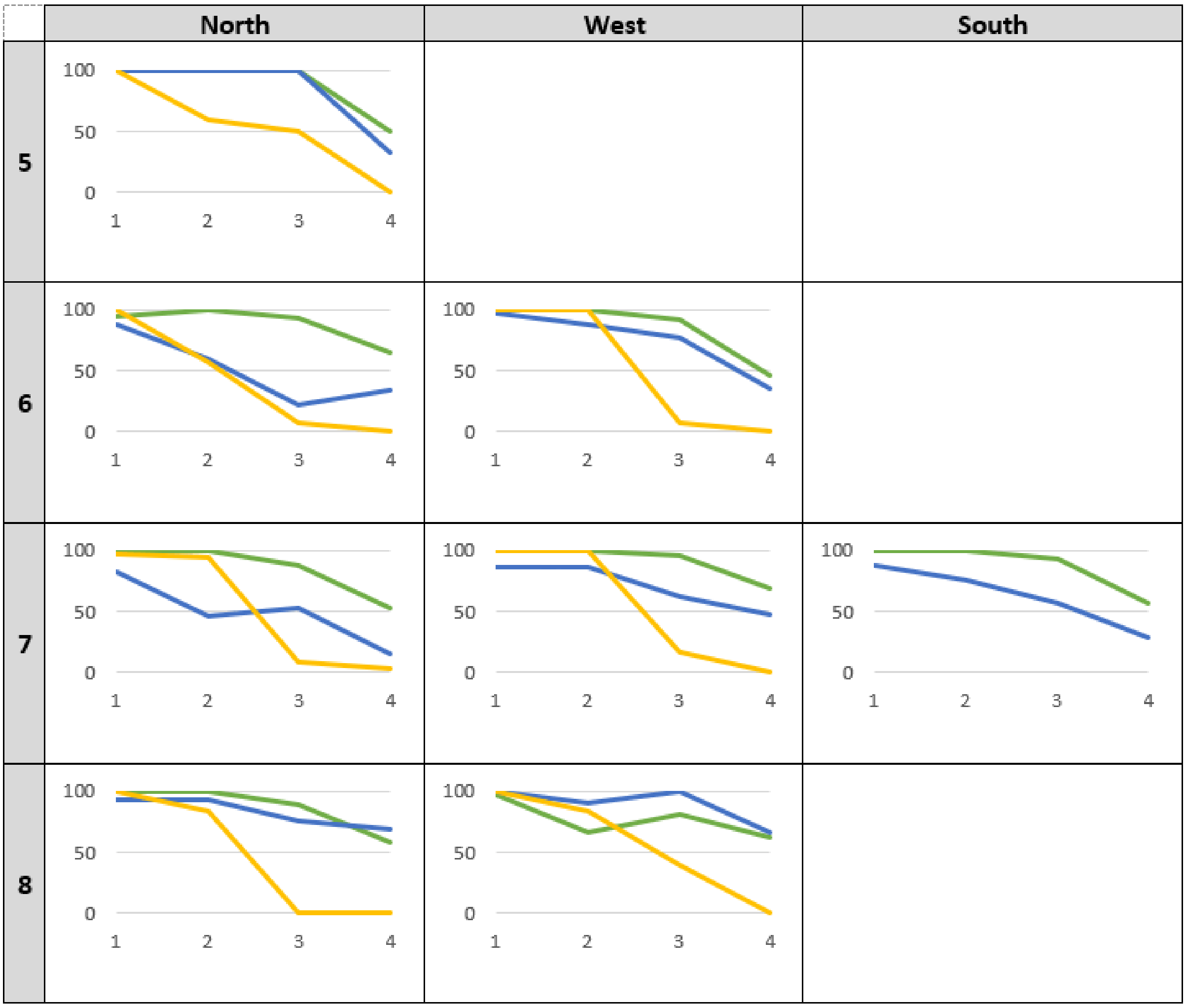


TABLE 7.9: Kill-off patterns based on fusion for medieval cattle, caprines and pig arranged by phase (down) and quarter (across). Key: green – cattle, blue – caprines, yellow - pig



7.3 Medieval

Age structures

The medieval kill-off patterns show some changes compared to Roman ones (Table 7.9). In all phases and areas within Exeter, pigs were kept for meat, though with some variation in the slaughter age and the proportion of animals kept into adulthood. Between 81% and 100% of all cattle were kept past fusion stage 3, with 46% and 65% remaining after stage 4. This drop in survival is not consistent with natural deaths, suggesting that cattle were primarily reared for traction with some late slaughter for meat.

The cattle ending up in phase 8 deposits from the West Quarter appear to be reared

TABLE 7.10: Cattle tooth wear and eruption as absolute counts from medieval phases and quarters

	North				West			
Wear Stage	5	6	7	8	5	6	7	8
A	-	1	-	-	-	-	-	-
B	-	-	-	1	-	-	-	-
C	-	-	-	-	-	-	-	-
D	-	-	2	-	-	-	-	-
E	-	-	-	-	-	-	-	2
F	-	-	-	-	-	-	-	-
G	-	-	2	1	-	2	-	-
H	-	-	3	-	-	-	-	-
I	-	-	1	1	-	-	-	-

TABLE 7.11: Caprine tooth wear and eruption as absolute counts from medieval phases and quarters

	North				West			
Wear Stage	5	6	7	8	5	6	7	8
A	-	-	-	-	-	-	-	-
B	-	1	1	-	-	-	-	-
C	-	-	-	-	-	-	1	-
D	-	2	9	-	-	-	-	-
E	1	1	4	-	-	2	1	-
F	-	-	4	-	-	2	5	1
G	-	2	2	1	-	1	2	-
H	-	1	1	1	-	-	-	-
I	-	-	-	-	-	-	-	-

in a different manner than the rest of medieval Exeter. At fusion stage 2 only 67% of all animals are still alive, meaning that a third of the herd has been slaughtered, which is a statistically significant drop ($p = 0.0282$), and despite some animals ‘coming back to life’ which is caused by the small sample size for fusion stage 2 ($p = 0.55$), the drop in cattle survival between fusion stage 1 and 3 from 97% survival to 81% is still significant ($p = 0.037$). As the survival at stage 2 and 3 is noticeably lower than anywhere else in the city it shows that the high-status household in the West Quarter ate meat from younger animals than the people living in the North Quarter. This suggests that either two herds supplied the dinner tables in this area of Exeter, one of them managed for meat and the other for working animals, or that it was a single herd with a mixed economy. Either way, the cattle deposited in the West Quarter were from a different stock or subject to a different selection process than the ones in the rest of Exeter.

TABLE 7.12: Pig tooth wear and eruption as absolute counts from medieval phases and quarters

	North				West			
Wear Stage	5	6	7	8	5	6	7	8
A1	-	-	-	-	-	-	-	-
A2	-	-	-	-	-	-	-	-
A3	-	-	-	-	-	-	-	-
B	-	-	1	-	-	-	-	-
C	-	-	5	-	-	-	1	-
D	-	1	2	-	-	-	-	-
E	-	-	2	-	-	2	-	1
F	-	-	-	-	-	1	-	-
G	-	-	-	-	-	-	-	-

Over time, there are clear differences in the management of caprine herds supplying Exeter and, similar to cattle, they also display different herd structures in contemporary material between the North, West, and South Quarters. Despite the much larger medieval datasets, there are once again some issues with the data in some phases and quarters, though none of the increases in 'survival' are statistically significant (P values between 0.25 and 0.39). What the data do tell us, is that people living in the North Quarter during phase 6 and 7 ate young caprines as opposed to older animals in phase 5 and 8 and in the West and South Quarters. This once again suggests that different herds supplied different parts of the city, with animals primarily reared for wool being the norm, and the younger animals turning up in the North Quarter being reared primarily for meat which was likely a result of a demand for more tender meat amongst the high-status citizens.

Overall, the information gleaned from tooth eruption and wear is limited as only a few mandibles were appropriate for this study from any given phase or quarter, though when available, it does not directly contradict the fusion data. The available data from the North and West Quarters are presented in Table 7.10, 7.11, and 7.12. Only two mandibles were identified from the South Quarter, they are both from phase 7 and one is from a caprine (wear stage H), and the other from pig (wear stage C). Caprine data are the most abundant and they do support the fusion data and reflect similar differences between phase 6 and 7 in the North and West Quarters. The data for pigs have little or no evidence for the culling of young animals, though this may be due to differential preservation of the bones themselves.

TABLE 7.13: Absolute counts of sex for major domesticates in medieval phases and quarters

			5	6	7	8
North	Cattle	Male	-	-	3	1
		Female	-	-	3	-
	Caprines	Male	2	1	16	-
		Female	-	4	8	-
	Pig	Male	-	1	5	1
		Female	1	2	3	-
West	Cattle	Male	-	1	1	-
		Female	-	-	1	-
	Caprines	Male	-	6	4	-
		Female	-	5	1	-
	Pig	Male	-	1	-	-
		Female	-	2	-	2
South	Cattle	Male	-	-	-	-
		Female	-	-	-	-
	Caprines	Male	-	-	-	-
		Female	-	-	-	-
	Pig	Male	-	-	-	-
		Female	-	-	-	-

Sex ratios

The data for sex differentiation during the medieval phases are also limited so they provide minimal insight into the herd management practices for most of the phases. Nonetheless, some attention should be drawn to the numbers of males and females from phase 7 in the North Quarter. The data suggest that males are twice as frequent as females though this ratio has been heavily biased by the inclusion of horncores in the dataset. For the 10 horncores that yielded sex, eight of them are males and the remaining two are females showing a clear preference for horns from males in the horn working industry. Pelves on the other hand, show a very different pattern with eight of the 14 specimens being male and the remaining six being female which is not a statistically different ratio ($p = 0.45$). So, while the age data show that caprines were culled at a younger age to supply the dinner tables of the North Quarter, which suggests rearing for meat, the sex ratio suggests that there was an equal slaughter of males and females which is indicative of a herd managed for wool. Some of the metric data may provide further insight into this discrepancy.

Size comparison

The available log-ratio data for medieval cattle, caprines, and pig, are presented in Tables 7.14 to 7.21. There are some outliers in the means, such as depth for cattle during phase 6, though these are a result of small sample sizes and when running t-tests on the data they are not statistically significant. In quarters and phases where large sample sizes are available, the mean values are very close and show that contemporary data from the different quarters are statistically similar. While there are no size changes in cattle within the medieval period in depth measurements, there is a shift in breadths. The log-ratio means indicate a slight drop in breadths from phase 6 and 7, though this is not statistically significant ($p = 0.088$), followed by an increase from phase 7 to 8 ($p = 0.0331$). Unfortunately, there are no depth data available from phase 8, though the ones from phase 6 and 7, while few in number and therefore not very reliable, show that there is a decrease in depths from phase 6 to 7 ($p = 0.028$) suggesting that cattle bones beaome less 'robust' in the High Middle Ages compared to the latter half of the Saxo-Norman period. Comparisons of the Roman data to the medieval phases also show that there is a breadth increase from the Roman period to phase 6 ($p = 0.0167$), though the Roman cattle breadths are similar to those from phase 7 ($p = 0.42$). This increase in breadth measurements between the Roman period and the century following the Norman Conquest suggests that the existing local cattle either changed part of their physical shape through selective breeding or as a natural change over eight centuries, or that new cattle were brought to the area by the Saxons or the Normans.

Caprine log-ratios are very stable throughout the medieval phases across Exeter suggesting no selective breeding or introduction of new stock took place. There is a breadth increase from the Roman period to phase 8 ($p = 0.00739$). The cause for this increase is unclear as there is at least 1000 years separating the datasets, therefore, multiple factors may be involved such as selective breeding, size change, climate, and introduction of new stock all of which can have slow impacts which may not turn up in the log-ratios between individual phases.

Unlike for cattle and caprines, t-tests on the Roman and medieval pig breadths show no change over time ($p = 0.23$). The small amount of metrical data for pigs makes it

TABLE 7.14: Phase 6 cattle log-ratios and means by measurement (down) and quarter (across)

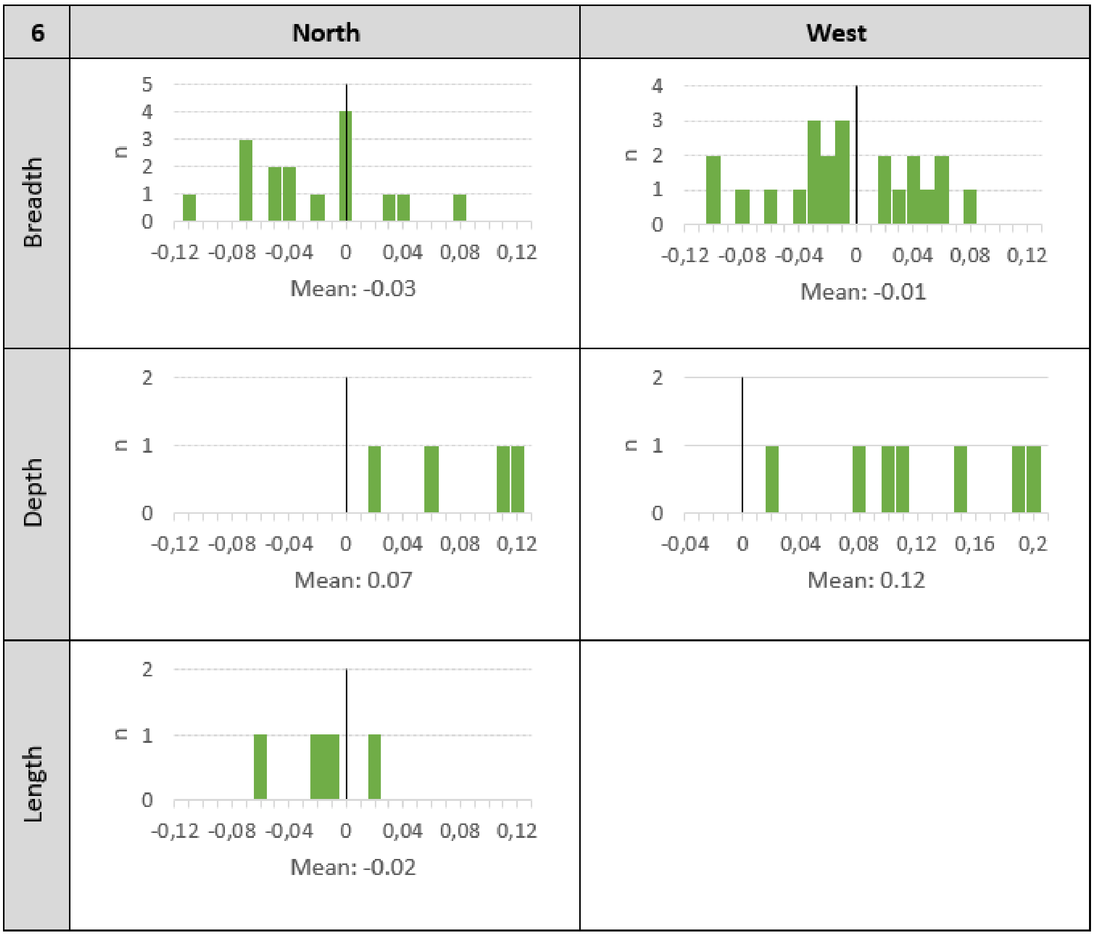


TABLE 7.15: Phase 7 cattle log-ratios and means by measurement (down) and quarter (across)

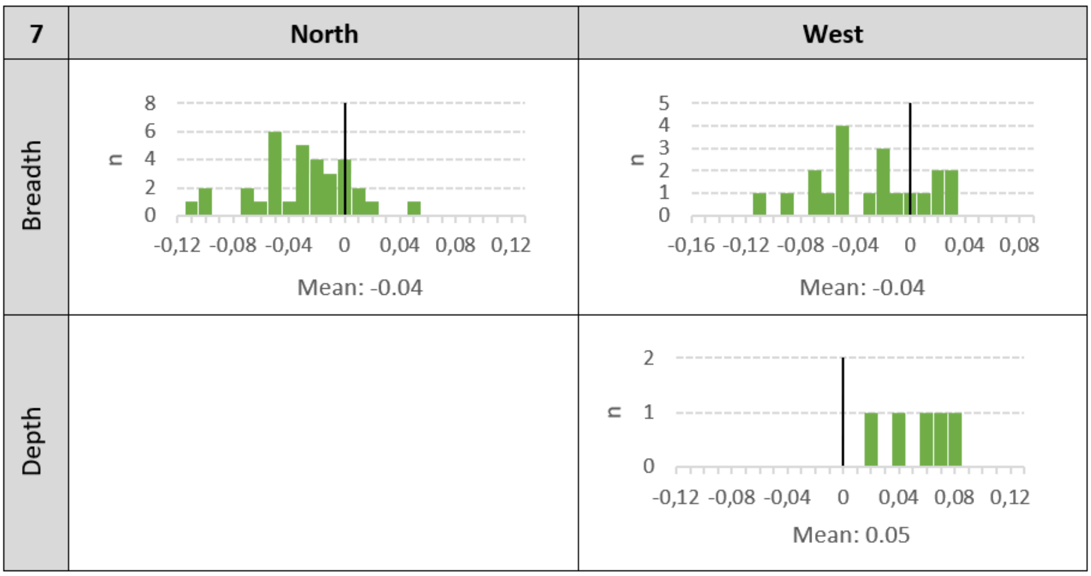


TABLE 7.16: Phase 8 cattle log-ratios and means by measurement (down) and quarter (across)

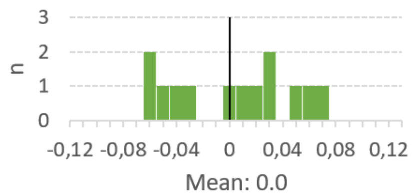
8	West
Breadth	

TABLE 7.17: Phase 6 caprine log-ratios and means by measurement (down) and quarter (across)

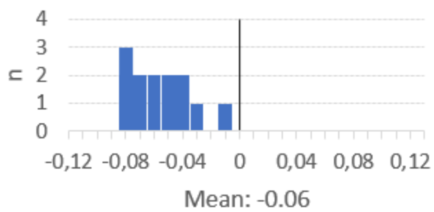
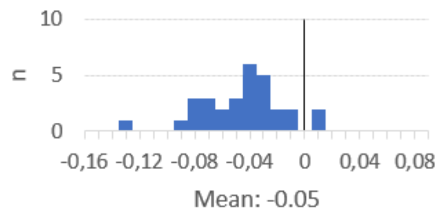
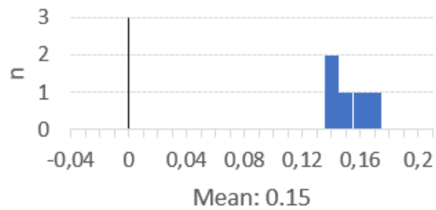
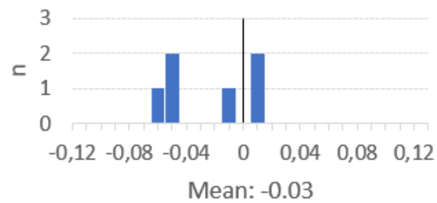
6	North	West
Breadth		
Depth		
Length		

TABLE 7.18: Phase 7 caprine log-ratios and means by measurement (down) and quarter (across)

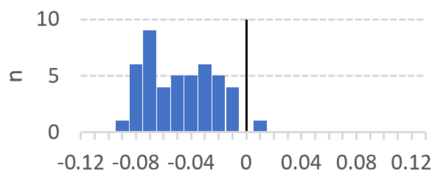
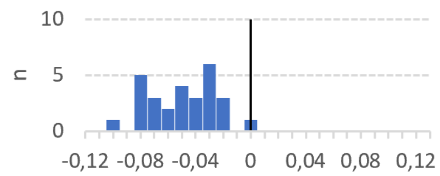
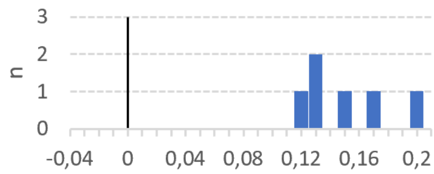
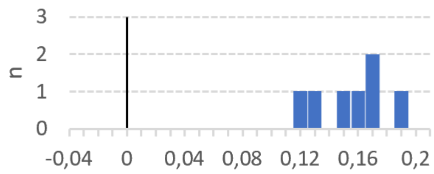
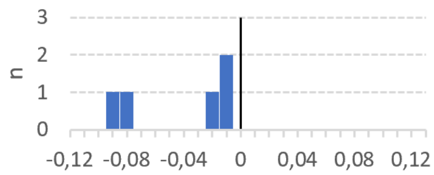
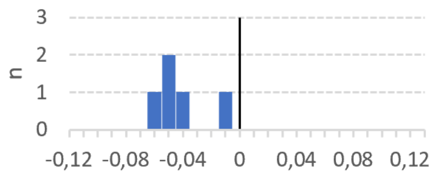
7	North	West
Breadth	 Mean: -0.05	 Mean: -0.05
Depth	 Mean: 0.15	 Mean: 0.15
Length	 Mean: -0.05	 Mean: -0.05

TABLE 7.19: Phase 7 caprine log-ratios and means from the South Quarter

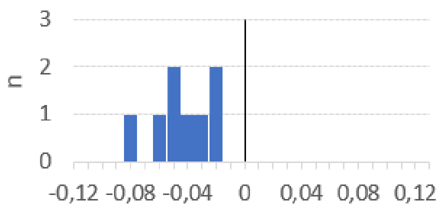
7	South
Breadth	 Mean: -0.05

TABLE 7.20: Phase 8 caprine log-ratios and means by measurement (down) and quarter (across)

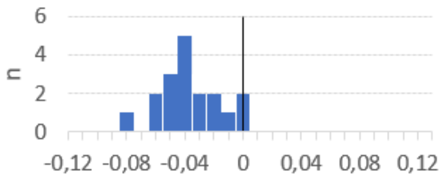
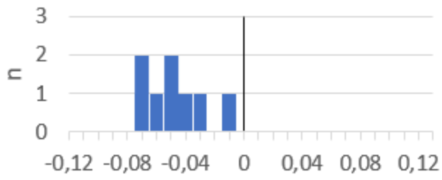
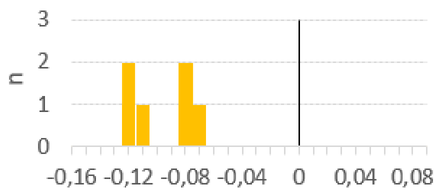
8	North	West
Breadth	 Mean: -0.04	 Mean: -0.05

TABLE 7.21: Phase 7 pig log-ratios and means by measurement (down) and quarter (across)

7	North
Breadth	 Mean: -0.1

difficult to assess if the lack of documented change is evidence for no metrical changes to the population or simply a result of the small sample size.

Discussion

In Maltby's (1979) study of Exeter, the tooth eruption and wear and epiphyseal fusion of cattle showed very similar results to the data above with the majority of animals being kept into full adulthood throughout the medieval period and as expected, pigs continue to be kept for meat throughout the period (Maltby 1979, 31, 55). The caprine age data are also broadly similar to the data from the North Quarter with a decreasing slaughter of young animals from the beginning of the 11th century to the end of the 15th (equivalent to phase 6, 7 and 8) (Maltby 1979, 43). The majority of Maltby's data are from the Goldsmith Street sites which are located in the North Quarter and may be why the patterns are similar to those presented above. The metrical analysis performed by Maltby, is also in agreement with the data presented above, showing no or very little improvement of cattle, caprines and pigs within the medieval period (Maltby 1979, 36, 49, 57).

Moving north to Lincoln, there is evidence for different management strategies of cattle. During the Late Saxon period (equivalent phase 5) cattle were culled between 9 and 18 months and at 2-3 years, whereas most Exeter cattle were at least 3 years old when slaughtered, though there are some indications that the Lincoln cattle survived longer in the later parts of the medieval period (equivalent to phase 6, 7 and 8) (Dobney et al. 1995, 31). Caprines on the other hand, were reared in a similar manner to the ones in the West Quarter in Exeter (Dobney et al. 1995, 31). Furthermore, the is no metrical evidence for the size improvement of cattle or caprines during the medieval period in Lincoln or indeed in York (Bond and O'Connor 1999, 406; Dobney et al. 1995, Figure 35, 36, 56, 57, 59).

In terms of kill-off patterns, the material from York highlights the influence of individual assemblages, as there is evidence for some parts of the city acquiring their meat from different herds under different management strategies. In most areas the cattle are adults, but The Bedern assemblage consists almost entirely of young calves or elderly cattle suggesting that they were animals culled from a dairy herd (Bond and O'Connor 1999, 385). With these inter-city variations in mind we should expect to find differences in the overall management structures of cities and towns such as the ones seen in Lincoln, rather than finding the same patterns in all urban assemblages.

7.4 Post-medieval

Age structures

The post-medieval fusion data are presented below as kill-off graphs in Table 7.22. As always, pigs are reared for meat, but while cattle were primarily kept as working animals in the Roman and medieval periods, they are now rarely kept into full maturity. Most of the animals are slaughtered after fusion stage 3 (12-36 months), so they are kept until they are approximately full adult size, suggesting that they are reared for meat, though with little slaughter for veal. Caprines are also managed differently compared to the medieval period. The majority of animals are kept until full skeletal maturity, and none

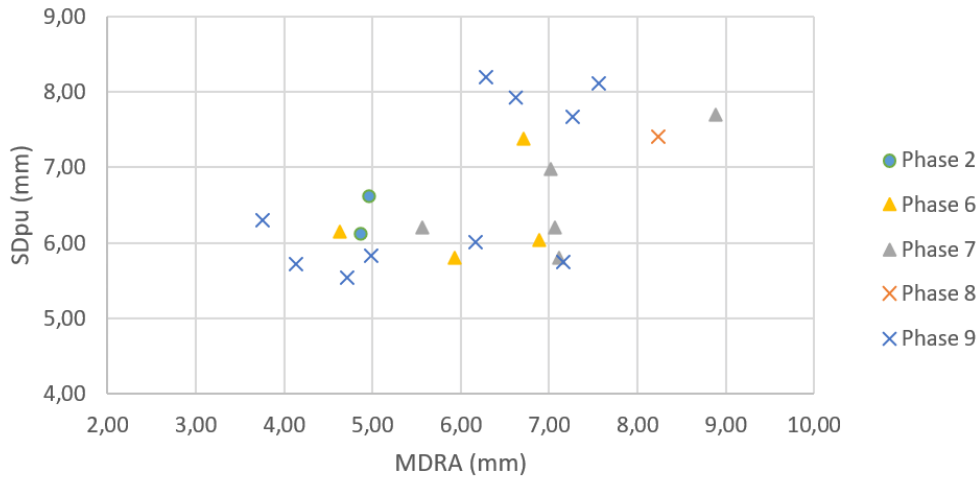


FIGURE 7.1: Scatter plot of caprine pelvic measurements

of the drops in the graphs are statistically significant, indicating that the dying we do see is most likely natural. This type of pattern is highly indicative of management for wool, which fits in nicely with the history of Exeter as the wool trade was at its peak during this period. In turn, this shows that the mutton turning up on the dinner tables was a side product of the wool industry and no animals were reared for meat.

The tooth wear and eruption data available from the North and West Quarters are presented in Table 7.23, 7.24, and 7.25 and while there are minimal data, they do show similar patterns to the fusion data from all three species, at least for the North Quarter. No mandibles suitable for wear stage analysis were recovered from the post-medieval phases in the South Quarter. Only four pig mandibles were suitable for the study of tooth eruption and wear, and unlike the Roman and medieval material, three of the four are from animals less than six months old. There is no evidence to show that there is better preservation of post-medieval bone compared to the previous two periods, so it is possible that they are deposited differently or that many more young animals are culled compared to earlier phases increasing the likelihood of a proportion of them surviving in the archaeological record.

Sex ratios

The available post-medieval sex data are presented in Table 7.26, and unfortunately, no specimens were appropriate for sex differentiation from phase 10 or the South Quarter.

TABLE 7.22: Kill-off patterns by fusion for post-medieval cattle, caprines and pig arranged by phase and quarter. Key: green – cattle, blue – caprines, yellow - pig

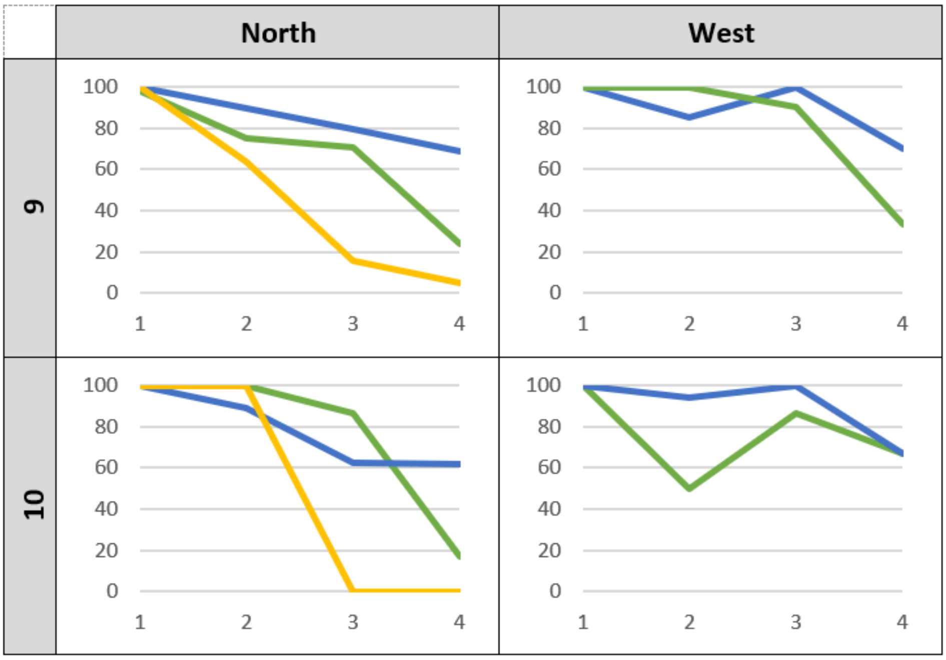


TABLE 7.23: Cattle tooth wear and eruption as absolute counts from post-medieval phases and quarters

	North		West	
Wear Stage	9	10	9	10
A	-	-	-	-
B	5	1	-	-
C	-	1	-	-
D	-	-	-	-
E	-	-	-	-
F	1	-	-	-
G	3	-	-	-
H	1	-	-	-
I	-	-	-	-

TABLE 7.24: Caprine tooth wear and eruption as absolute counts from post-medieval phases and quarters

	North		West	
Wear Stage	9	10	9	10
A	-	-	-	-
B	2	-	-	-
C	-	1	-	-
D	-	-	-	-
E	1	1	-	1
F	2	1	-	-
G	1	-	1	4
H	1	-	-	-
I	-	-	-	-

TABLE 7.25: Pig tooth wear and eruption as absolute counts from post-medieval phases and quarters

	North		West	
Wear Stage	9	10	9	10
A1	1	-	-	-
A2	1	-	-	-
A3	-	-	-	-
B	1	-	-	-
C	-	-	-	-
D	-	1	-	-
E	-	-	-	-
F	-	-	-	-
G	-	-	-	-

TABLE 7.26: Absolute counts of sex for major domesticates by phase and quarter

			9	10
North	Cattle	Male	-	-
		Female	-	-
	Caprines	Male	7	-
		Female	-	-
	Pig	Male	1	-
		Female	2	-
West	Cattle	Male	-	-
		Female	1	-
	Caprines	Male	-	-
		Female	1	-
	Pig	Male	1	-
		Female	1	-
South	Cattle	Male	-	-
		Female	-	-
	Caprines	Male	-	-
		Female	-	-
	Pig	Male	-	-
		Female	-	-

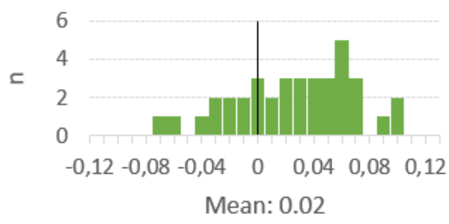
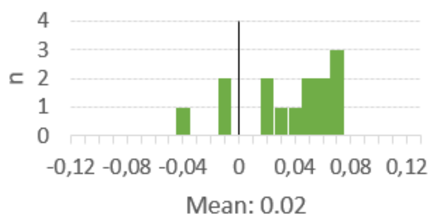
The seven identified male caprines from phase 9 in the North compared to no females is statistically significant (p = 0.00468), which indicates that males are more likely to be used for meat supply than females. From a herd management perspective, this makes sense as one would want to keep the females in the flock for breeding. To shed further light on the sex ratios, additional measurements were taken on pelves using the method presented in Popkin et al. (2012). As this method does not rely on visual examination but on the relationship between measurements taken on the acetabulum and pubic bone, it can reveal the presence of both males and females as well as wethers which cannot normally be identified. The data from this study are presented in Figure 7.1. All phases have been plotted on the same graph to maximise the information, though when interpreting the data, it should be kept in mind that in terms of long bone breadths the post-medieval caprines are larger than the Roman and medieval ones. This size change is discussed further below along with the log-ratio data. The specimens plotting towards the top right corner of Figure 7.1 are males both according to this graph and visual examination, and the ones towards the bottom left corner are females. A smaller number of specimens that could not previously be sexed plot in between males and females showing that wethers are present in both medieval and post-medieval Exeter. The presence of castrated males evidence a more complex management structures than can be gleaned from traditional age profiles, metrics, and sex studies, and this additional study shows that males and females are present in equal numbers in the phase 9 material while wethers are present in smaller numbers. This even ratio between the sexes combined with the age profiles showing only natural deaths adds further support to the interpretation that caprines were managed exclusively for wool and the meat was a natural side product.

Size comparison

When looking log-ratios and the long-term trends throughout the three periods, it becomes apparent that the means for all three species increase over time (Table 7.27 to 7.31). For cattle, the overall size of the animals appears to be increasing as the log-ratio means for both breadth and length measurements grow over time, particularly in the post-medieval period (Table 7.32). The depth means, on the other hand, vary more within all periods, but do not show a clear tendency for an overall increase or decrease over time, suggesting that depth log-ratio means are less reliable when using this method for looking at size changes in cattle. The lack of reliability of the means shows the importance of running statistical test as a key component in understanding what our data are really telling us. Looking at the breadth log-ratios in more detail, the greatest increase between consecutive phases is from phase 7 to 8 ($p = 0.0331$) while none of the other increases between consecutive phases are statistically significant. Moving on to long-term trends, all comparisons between phase 9 and any Roman or medieval phases are highly statistically significant ($p = 0.001$) showing that metrical changes in cattle are typically slow moving though with the largest breadth increases starting during the Late Middle Ages and continuing throughout the post-medieval period. This increase during the later phases is likely the result of deliberate livestock 'improvement', though introduction of stock from other areas cannot be excluded.

The picture for caprine metrical changes is more complex than that of cattle. As discussed previously, there is a significant increase in breadths from the Roman period to the Late Middle Ages, though the changes that start at the end of the medieval period

TABLE 7.27: Phase 9 cattle log-ratios and means by measurement (down) and quarter (across)

<table>
<tr><th>9</th><th>North</th><th>West</th></tr>
<tr><td>Breadth</td><td>
</td><td>
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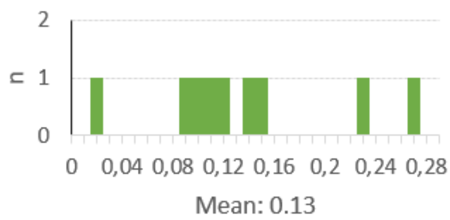
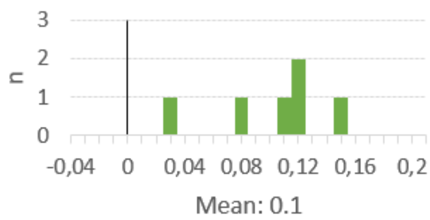
<tr><td>Depth</td><td>
</td><td>
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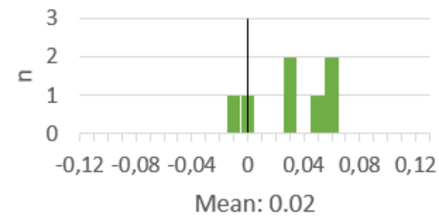
<tr><td>Length</td><td>
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TABLE 7.28: Phase 10 cattle log-ratios and means by measurement (down) and quarter (across)

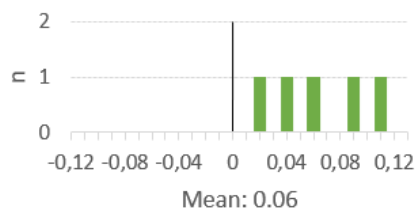
<table>
<tr><th>10</th><th>West</th></tr>
<tr><td>Breadth</td><td>
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TABLE 7.29: Phase 9 caprine log-ratios and means by measurement (down) and quarter (across)

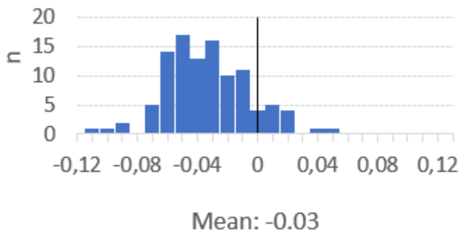
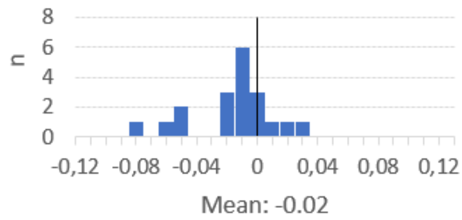
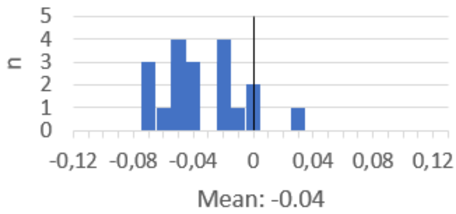
9	North	West
Breadth		
Length		

TABLE 7.30: Phase 9 caprine log-ratios and means from the South Quarter

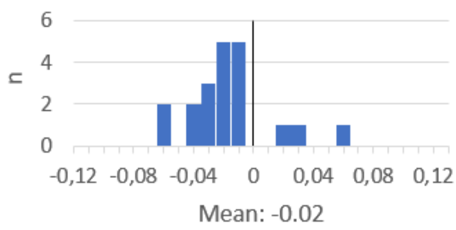
9	South
Breadth	

TABLE 7.31: Phase 10 caprine log-ratios and means by measurement (down) and quarter (across)

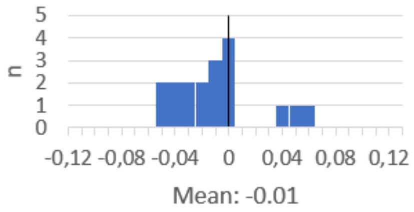
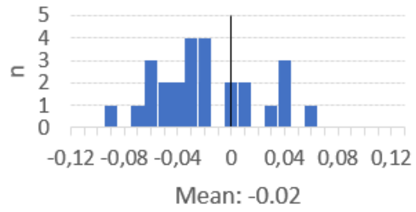
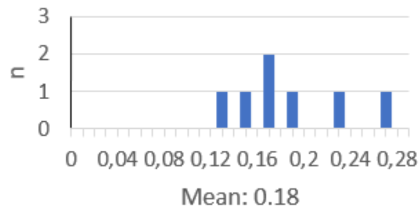
10	**North**	**West**
Breadth		
Depth		

TABLE 7.32: Summary of cattle log-ratio means by phase and quarter

Phase	Quarter	Breadth	Depth	Length
1		-0.04	0.11	-
2		-0.04	0.08	-0.03
3		-	-	-
5	N	-	-	-
	W	-	-	-
	S	-	-	-
6	N	-0.03	0.07	-0.02
	W	-0.01	0.12	-
	S	-	-	-
7	N	-0.04	-	-
	W	-0.04	0.05	-
	S	-	-	-
8	N	-	-	-
	W	0.0	-	-
	S	-	-	-
9	N	0.02	0.13	0.02
	W	0.02	0.10	-
	S	-	-	-
10	N	-	-	-
	W	0.06	-	-
	S	-	-	-

TABLE 7.33: Summary of caprine log-ratio means by phase and quarter

Phase	Quarter	Breadth	Depth	Length
1		-0.07	-	-
2		-0.06	0.14	-0.03
3		-	-	-
5	N	-	-	-
	W	-	-	-
	S	-	-	-
6	N	-0.06	-	-
	W	-0.05	0.15	-0.03
	S	-	-	-
7	N	-0.10	0.15	-0.05
	W	-0.05	0.15	-0.05
	S	-0.05	-	-
8	N	-0.04	-	-
	W	-0.05	-	-
	S	-	-	-
9	N	-0.03	-	-0.04
	W	-0.02	-	-
	S	-0.02	-	-
10	N	-0.01	-	-
	W	-0.02	0.18	-
	S	-	-	-

and throughout the post-medieval period are far from linear. Within the North Quarter, there is no increase in breadths between phase 8 and 9 ($p = 0.71$), though caprines from other herds are entering the West and South Quarters as these animals are larger than in the North Quarter ($p = 0.0121$) and any of the phase 8 caprines ($p = 0.001$). The caprine size in these two quarters then remain the same into phase 10 ($p = 0.92$), while the animals in the North Quarter increase in breadth ($p = 0.00248$) until they catch up with the larger caprines so all animals entering Exeter during phase 10 appear to be the same size in terms of breadth ($p = 0.26$). The complexity of these changes seems best explained by different herds supplying the various areas city, with some of the herds either being new stock from other areas or subject to selective breeding resulting in increases in breadths of the long bones.

TABLE 7.34: Summary of pig log-ratio means by phase and quarter

Phase	Quarter	Breadth	Depth	Length
1		-0.09	-	-
2		-0.10	-	-
3		-	-	-
5	N	-	-	-
	W	-	-	-
	S	-	-	-
6	N	-	-	-
	W	-	-	-
	S	-	-	-
7	N	-0.1	-	-
	W	-	-	-
	S	-	-	-
8	N	-	-	-
	W	-	-	-
	S	-	-	-
9	N	-	-	-
	W	-	-	-
	S	-	-	-
10	N	-	-	-
	W	-	-	-
	S	-	-	-

Discussion

Selective breeding for improvement of cattle is fairly well documented in the post-medieval period through records of carcass weights. While the estimated weights are affected by things such as age, butchery methods, and fat weight, so they need to be used with caution. It is suggested that a butchered oxen carcass in the late 16^{th} century could weigh around 650 lb with the weight increasing to over 2100 lb by the end of the 18^{th} century (Rixson 2000, Table 13.1 and Table 13.2). Thomas (2005) has demonstrated the centuries long process of improvement from the 14^{th} onwards which is clearly reflected in Exeter in slow increase observed in caprines at the end of the medieval period and the more rapid changes observed in the post-medieval phases. In the urban archaeological record the post-medieval improvement of all livestock species has also been documented in various places including Lincoln and by Maltby in Exeter as well as other urban and rural sites across England. Similar to this study, Maltby also saw some evidence of size increase between the Roman and medieval period but with the most obvious changes happening in the post-medieval period (Maltby 1979, 92). In Lincoln, the same tendency for size rather than height increase was also observed in caprines, whereas in cattle, it is all both size and height that increase dramatically in the post-medieval period (Dobney et al. 1995, 40, Figure 46-49). Corresponding shifts in Exeter cattle age profiles were also observed with higher numbers of younger animals being culled for meat, though the fusion and tooth wear ages for caprines give contradicting profiles. While the pattern is unclear, the fusion data suggest that a much greater number of mature animals were killed in this period compared to previously, and once again a similar pattern is repeated in Lincoln (Dobney et al. 1995, 31, 40; Maltby 1979, 32, 42). Overall, these parallels in geographically distant sites are highly suggestive of national trends shifting during this period as opposed to local, isolated developments.

7.5 Sheep/goat separation

A topic that should be discussed in relation to livestock exploitation is the differentiation of sheep and goat specimens. Sheep/goat identification is a whole subject on its own,

TABLE 7.35: Caprine horncore absolute counts

Phase	Sheep	Goat
1	-	-
2	2	5
3	-	-
R	1	2
5	-	2
6	1	9
7	5	25
8	3	2
M	6	13
9	-	-
10	1	-
PM	1	1

so it will only be touched on briefly here, as it was not made a priority in this particular study though it does deserve in depth analysis in the future.

These two species are notoriously difficult to differentiate, though there are some elements that can distinguish between then and give us a better picture of the abundance of either species. When looking at the numbers of horncores identified either to sheep or goat it is clear that goat outnumber sheep in almost all phases (Table 7.35). Based on this information, one would expect the majority of post-cranial elements to also be from goat, yet Figure 7.3 and 7.4 show that this is not the case. Only single metapodia could metrically be identified as goat, with the remaining ones all being sheep, or unclassified. These two types of data clearly contradict each other, so either the metric separation is not accurate, or sheep and goats are utilised and deposited in very different ways, the latter of these two options being the most likely. Assuming that both the horncore and metrical differentiations are correct, this shows us that goat almost solely turns up as horncores which is highly suggestive of them only being used in an urban setting to supply the horn industry. This interpretation is strongly supported by Levitan's finds at the Exe Bridge site just outside the West Gate (see Figure 4.1, site 56). In the 13th century material from this site, 450 horncores were identified, 422 of which were goat, showing just how important this species was to the industry comparative to sheep (Levitan n.d. a, Table 8). Sheep, on the other hand, are clearly the dominant species of the two when it comes to supplying meat, and if the metrical separation is representative of the whole animals and not just the lower legs, then it is only sheep supplying the wool industry.

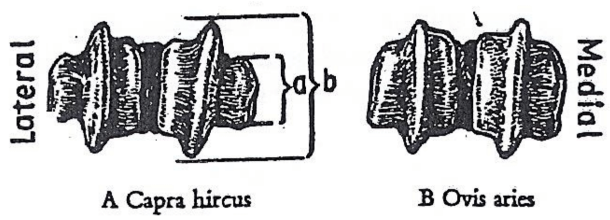


FIGURE 7.2: [Boessneck's (1969) guide to measuring caprine metapodia

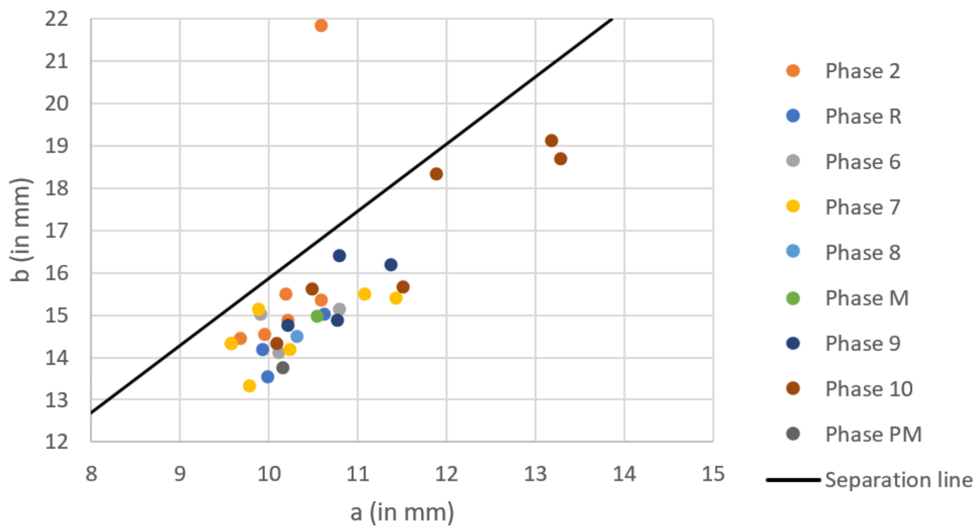


FIGURE 7.3: Scatter plot of sheep/goat separation by metacarpal measurements using Boessneck's measurements in Figure 7.2

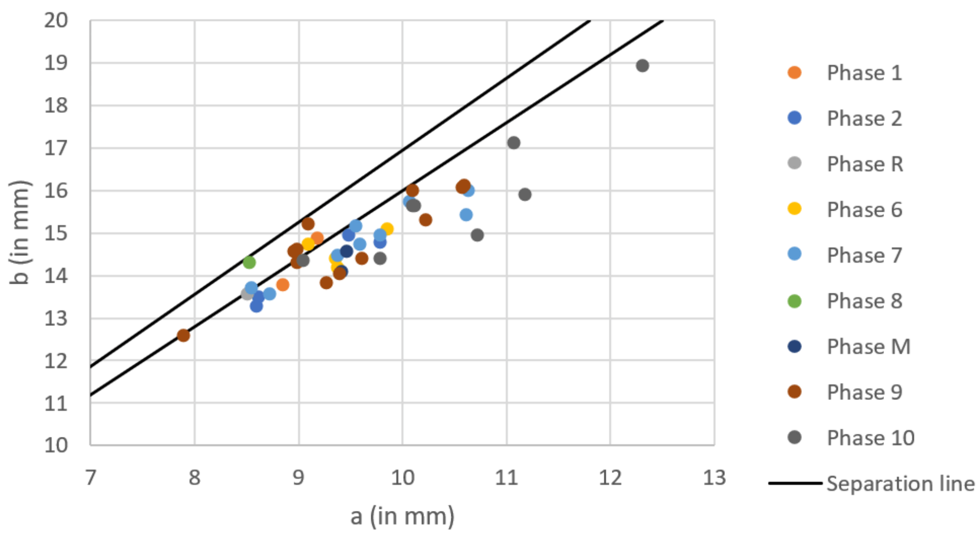


FIGURE 7.4: Scatter plot of sheep/goat separation by metatarsal measurements using Boessneck's measurements in Figure 7.2

Metrical separation is only applicable to fully fused metapodia, so only adults over 2-3 years can be used in the study and it is therefore unknown if younger goats are present as part of the meat supply to Exeter. Furthermore, it is currently unknown where the goat horncores are coming from and where the post-cranial elements are, so in the future, a much more detailed analysis focussing solely on caprines should be applied utilising scientific methods such as proteomics which would allow the study of a large number of specimens while keeping the cost relatively low.

7.6 Summary

The way in which caprines and cattle were managed change over time while pigs were at all times reared for meat with a large number of young animals culled. From the Roman military phase until the end of the medieval period cattle were kept almost exclusively as working animals though in the late medieval material from the West Quarter there are some indications of a shift towards rearing for meat. During the Roman occupation, caprines were primarily managed for meat and in the North Quarter this continued until the end of the High Middle Ages. In the medieval West Quarter and late medieval North Quarter, the animals were all kept for wool before they were used to supply Exeter with mutton.

Within the individual time periods and between consecutive phases there is very little or no evidence for size or shape changes in the livestock, but when looking at long-term temporal trends, changes do become apparent. Almost all the evidence for changes in the species is from breadth measurements rather than depth or length, showing that it is the shape/size of the animals that changes rather than the height. Cattle increase in size between the Roman period and the second half of the Saxo-Norman period (phase 6) and again between the High and Late Middle Ages (phase 7 and 8) followed by continued increases throughout the post-medieval period. Caprines remain the same size from the Roman military phase until the High Middle Ages, but improvements are apparent in the late medieval phase and continue throughout the post-medieval period, though with the larger animals first being introduced into the West and South Quarters and only into the

North Quarter in the latter half of the period. Unfortunately, there is not enough evidence is available to determine if pigs see similar changes to cattle and caprines.

Chapter 8

From military fortress to vibrant city – continuity and change

8.1 Introduction

This chapter aims to crystallise the bigger picture changes over time. An attempt will then be made to tie all of the information from this chapter and the previous three chapters into an overview of what is going on in Exeter from the beginning of the Roman occupation in AD 55 and up until the late 18^{th} century. This overview will be compared and contrasted with other urban zooarchaeological studies in England to have a look at national trends and to understand how Exeter fits in to a bigger picture.

8.2 The Roman fortress and town

There is some evidence of differences in meat consumption between the Roman military phase and the civilian town. In terms of proportions of species, cattle are present in greater numbers in the Roman period than in any of the following phases or periods, with their greatest frequency being during the Roman civil phase (Figure 8.1) which is consistent with trends across Roman Britain (King 1999, Table 3; Rippon 2012, 263). As cattle increase in frequency from the Roman military to the Roman civil phase, pigs see the opposite effect and decrease in numbers, while the proportion of caprines remain the same throughout the three Roman phases. There are also some shifts in what portions

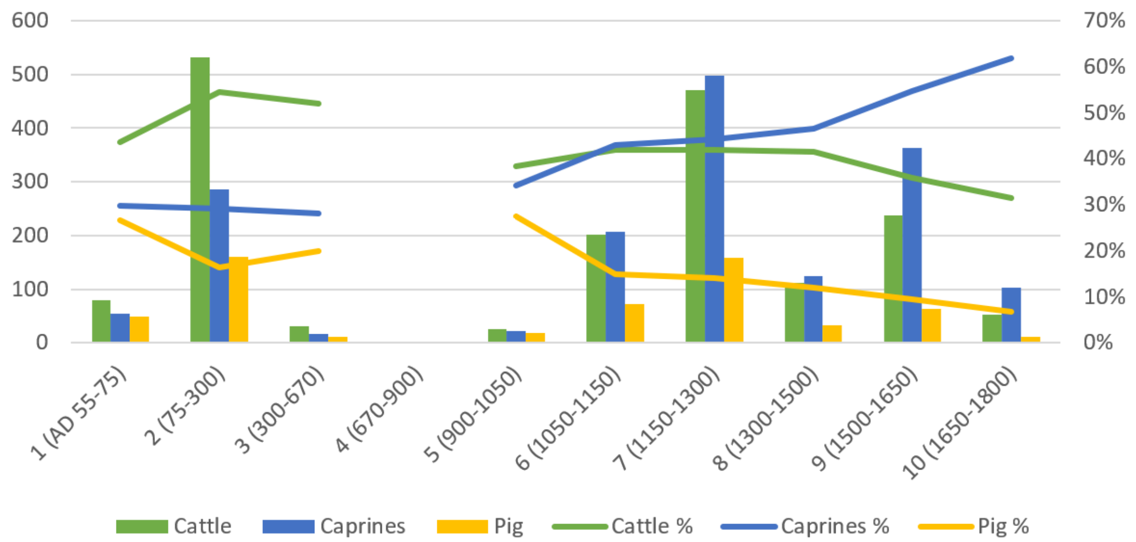
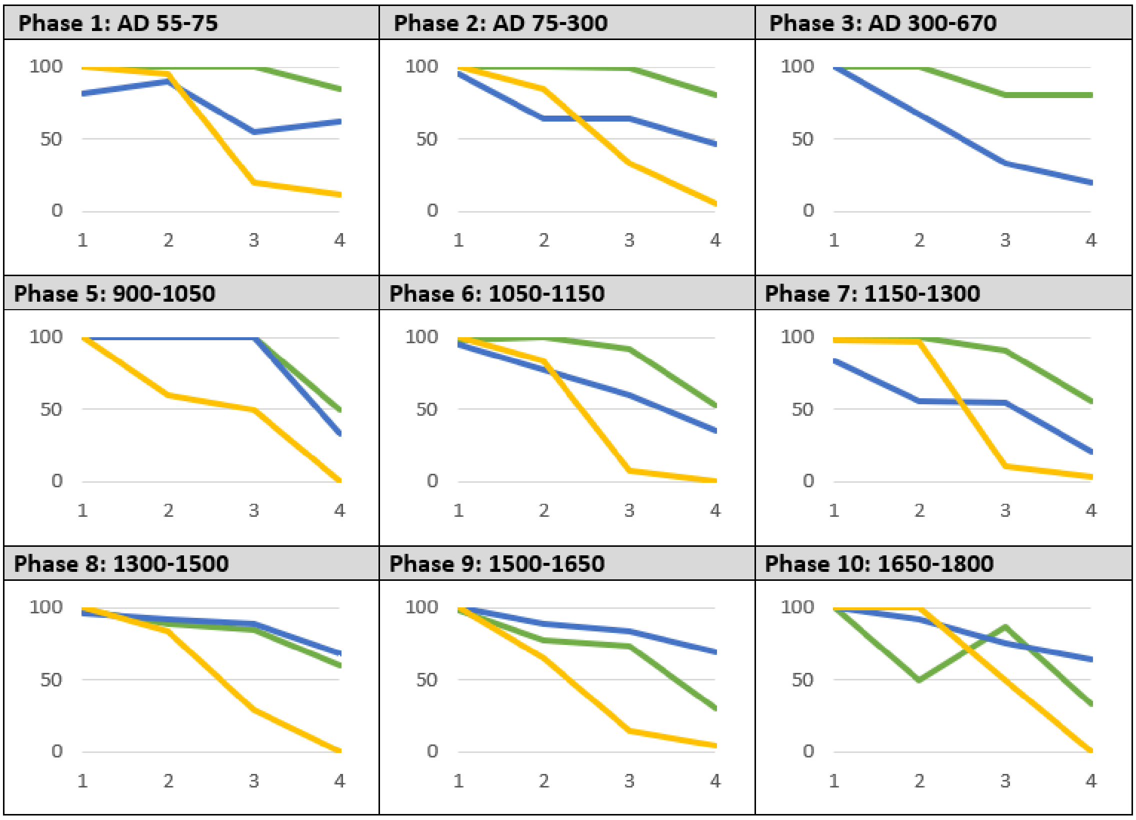


FIGURE 8.1: Overall MAU of major livestock species by absolute numbers and percent from this study.

of the animals are favoured with cattle shoulders being particularly numerous in the Roman civil phase yet does not occur in the preceding phase. Similarly, cattle were also the most frequently exploited species for marrow extraction. While the proportions and preferred portions and parts of these species change, the herd management styles remained unaffected by the shifts in 'popularity'. Before being slaughtered for meat, all cattle were used as working animals and kept into full adulthood while pigs were reared specifically for meat and caprines have more of a mixed management strategy.

In terms of the broader picture of Roman livestock consumption in Britain, Exeter reflects the average trends seen in other Romano-British legionary fortresses and urban settlements (King 1999, Table 3). This once again showing how interconnected and uniform the sites and people were within the Empire just like the butchery patterns and skeletal part abundances suggested, and partly by age profiles as well (Chapter 5 and 7; Table 8.1). Nonetheless, there are variations between sites as described in section 2.2.2. In the material from Fennings Warf in London, pigs are the most frequent followed by cattle and with very few caprines (Rielly 2001, Table 9 and 10), while in Lincoln and at the General Accident Site in York cattle dominate in an even greater extent than what is seen in civil Exeter, and Bath stands out with caprines being the most frequent livestock (Figure 2.7). When getting into more detail, the temporal variation in proportions seen in both Exeter (Figure 8.1) and Lincoln (Table 2.5) illustrates some of the issues with

TABLE 8.1: Overview of age profiles from Chapter 5



using average numbers as a comparison. Though they are still useful as a benchmark and for looking at broad trends, the individual sites typically have much more complex patterns likely affected by the location, site type, and level of 'Romanisation' within the local population.

For the military material, the widespread overall consistency is also likely to be a reflection of the provision/regulation of food from a governing body. According to some historic sources, each Roman fortress was provided with enough supplies to last a full year, at least in terms of grain, and the basic diet during peace-time would consist of these grains, bacon, and cheese probably alongside vegetables (Davis 1971). This diet could be supplemented in various ways such as purchasing goods from shops, gifts from family, or by hunting, the latter of which is well documented in the archaeological record (Davis 1971, Table 1). The faunal remains from Exeter, along with a range of other studies, have also highlighted just how far from the supposed basic military diet the reality was. While pork is indeed consumed in a greater quantity in the military phase than at any other time, apart from phase 5, it was far from the main source of meat and other animal products (Chapter 5 and 6; Figure 8.2). Nonetheless, as described above, the shift from a military occupation to civilian did see a drop in pig numbers in Exeter so it is possible that the lack of prescribed pork in the diet resulted in this decrease. Unfortunately, the use of bacon specifically is very hard to trace in the archaeological record as it is belly meat and will therefore only leave cuts on ribs or none at all, so we cannot determine if this was indeed the cause for the decrease in pork in the Roman diet.

Hunting is well-evidenced in all periods in Exeter. As indicated by documentary evidence, the Roman diet is supplemented with game species and in the Roman military phase 5% of all specimens are from game, which is a much greater than in any later phase, though only three species are exploited (Table 8.3, 8.4, and 8.5). The number of game species increases from three in the military phase to eight in the Roman civil phase, with the species represented showing more diverse hunting strategies and the presence of waterfowl suggests that the wetland areas further down the River Exe were exploited. A late 3^{rd}-century pit uncovered during the Princesshay excavations (East Quarter) further underlines that hunting was a part of the Roman lifestyle for at least some of the population (Coles 2015). The majority of the faunal remains from this context were bird specimens primarily from chicken but a wide range of wild species were identified as well such as woodcock, duck, passerine, wader, water rail, pigeon, and corvid which shows the diversity of exploitation and in particular underlines the use of wetland environments. Of the livestock present in the pit alongside the birds the majority is represented by pig, with approximately 30% of the bones being from juveniles, whereas cattle dominate the general faunal assemblage corresponding to the data presented above and in Maltby's analysis (Coles forthcoming; Maltby 1979). It has been argued that pork was seen as a high-status food in the Romanised world (King 1999) and the pit from Princesshay supports this interpretation. Interestingly, there are some indications that deer, and probably hare and wild boar hunting is also linked to high-status Roman society (Maltby 2014) all of which have been identified in Exeter, though the wild boar is only a probable one (Table 8.3; Maltby 1979). It should also be kept in mind that the deposits analysed for this study had not been sieved, so the absence of small animals like passerines is to be expected,

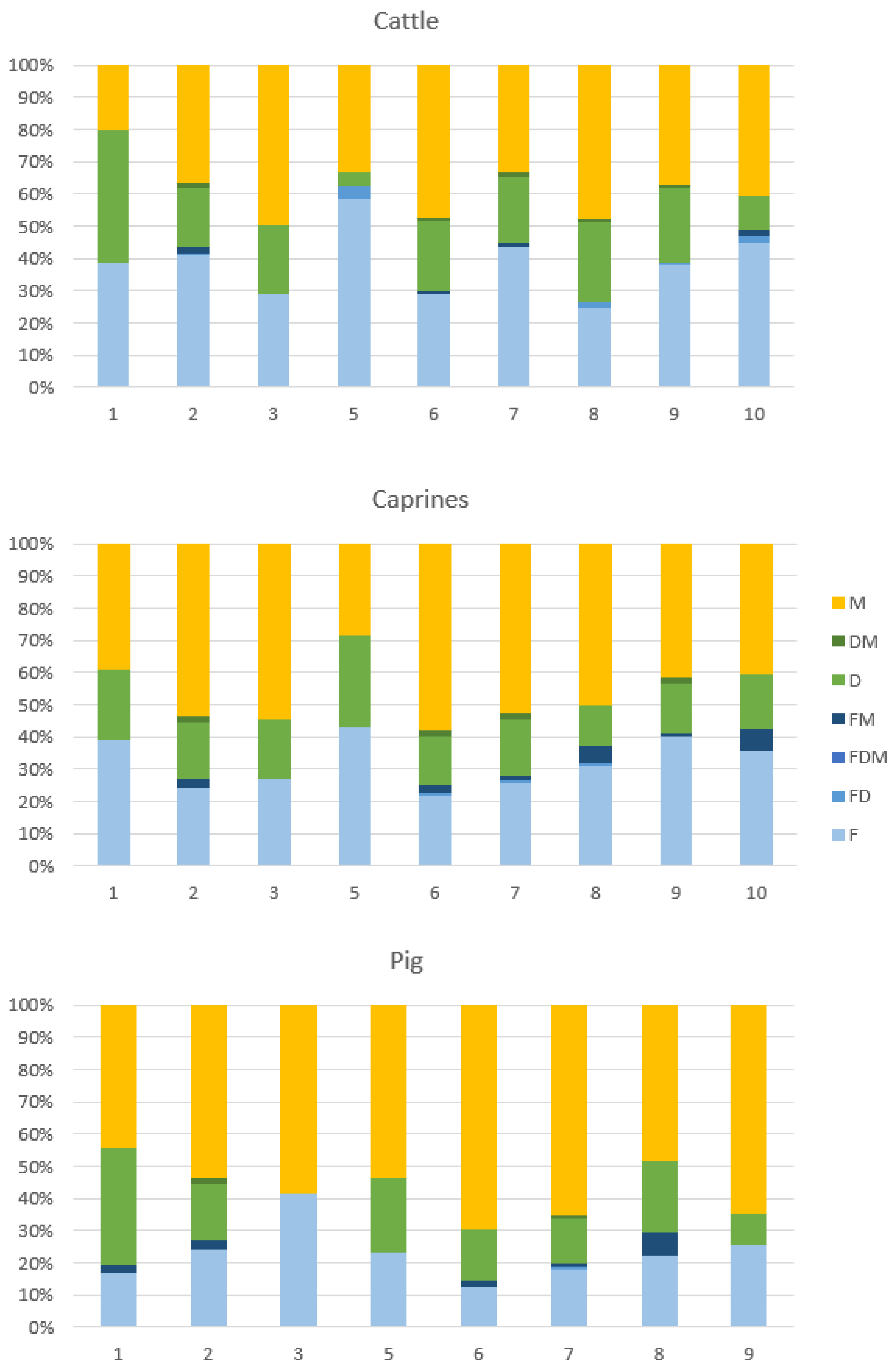


FIGURE 8.2: Overview of fracture history profiles from Chapter 6.

meaning that the full extent of hunting in the Roman or any of the later periods will remain unknown; we can only say for certain that they were, as a minimum, hunting large mammals. As the proportion of game specimens in the assemblages decrease from 5% in the Roman military to 1% civil phases according to this study, it, indicates some possible shifts in population structure or in the general attitude to hunting. If assuming that game is a high-status indicator, the decrease in proportion, despite the increasing number of exploited species, suggests that the proportion of high-status people in the population decreased with the shift in settlement status, though it is possible that the right to hunt had a different meaning within the military than it did in a secular setting. As mentioned above, game is present in almost all sites included in Davis' (1971, Table 1) study of the Roman military diet with 31 of 33 sites having red deer present, 17 having roe deer, and 14 for both wild boar and hare. It was probably a relatively rare addition to the diet, if the proportion of game in the military Exeter is anything to go by, yet it does still show that it occurred in almost all military sites. As mentioned above, Davis (1971) suggests that hunting was a way of supplementing the diet rather than an activity restricted to the higher-ranking members of the military, which would explain why it is more common in the military material than in any other phase or area.

In urban civilian sites like Roman Lincoln and York (General Accident Site) game has been recorded as well, though in smaller proportions than in Exeter. In York 0.5% of the Roman identifiable specimens were from mammalian game species (O'Connor 1988, Table 18), and in Lincoln the proportion is 0.4% (Dobney et al 1995, Table 7). When not including birds, the proportion of game in Roman civil Exeter is 0.7%, so it is only marginally higher, which may be a relic of the military past.

In the late and post-Roman town (phase 3) there is only a small amount of faunal remains available from study which could be a reflection of a drop in population size by the end of the 4^{th} century. While only indicative, the livestock proportions for this phase show a continuation of the Roman civil patterns, yet the meaty parts of the cattle carcasses are absent from the material compared to the previous two phases while humeri from both caprines and pigs occur in higher proportions than previously (Chapter 5).

The marrow exploitation also shows a decreasing reliance on cattle marrow while fracture evidence suggests that pig marrow may have been up to twice as frequent as in phase 2 (Chapter 6; Figure 8.2). The phase 3 livestock proportions from this study (Figure 8.1) may not be particularly reliable due to the small sample size. Fortunately, Maltby (1979) analysed a much larger quantity of data from the 4^{th} and early 5^{th} centuries with almost identical livestock proportions to those in phase 2 and 3 from this study (Maltby 1979, Table 5) suggesting that the data from this study are reliable. The skeletal part abundances (Chapter 5) show continuation of the patterns seen in the previous centuries, though with additional deposits of skull and jaw fragments which are assumed to be associated with a farmyard adjoining the site in question and a sign of slaughter and primary butchery.

Looking at the broader picture of livestock exploitation in Roman Britain some differences and similarities apparent between Exeter and other sites. Overall, the civilian town exhibits the same proportions of livestock compared to the general average, while the military fortress occupants have more of a mixed preference between the species compared to the average legionary site which has a much larger proportion of cattle specimens and less of caprines and pig (King 1999, Table 3). It should be kept in mind that King's (1999) data are based on NISP rather than MAU which means that cattle will appear more numerous than the other species. In Wroxeter the proportion of pig shows a slight increase in the centuries between late 3^{rd}-4^{th} century and the early 6^{th} to 7^{th} century while caprines become less frequent and cattle increase in numbers (Hammon 2011, Fig. 2). In Dorchester, geographically closer to Exeter, a similar change in pattern is seen to Wroxeter. During the late Roman occupation (late 2^{nd}-4^{th} century) caprines are the most prevalent livestock species (57% of identifiable livestock specimens) followed by cattle, 36%, and lastly pig, making up 7%. By the end of the occupation (4^{th} century) there is a decrease of caprines, and an increase in cattle and pig (Hamilton-Dyer 1993, Table 29), suggesting a similar dietary reaction to the decline of the Roman occupation in both Wroxeter and Dorchester. The late Roman livestock proportions in Exeter are most similar to Wroxeter, yet, in Exeter, there is no apparent reaction in exploitation linked to the decline of the Roman Empire. This could be a genuine trend showing a resilience to change in the population, or, and more likely, the faunal material in the AD 300+ category (phase 3) does not represent the decline of the Empire, but rather the first half of the 4^{th} century when the population was larger and Roman Exeter was still prospering.

8.3 The medieval period

From the end of the Roman occupation until the beginning of the Saxo-Norman period in the 10^{th} century, there is a gap in our knowledge about what was happening in Exeter. The town was settled, yet there is very minimal evidence for the people who lived in it or how they consumed and interacted with animals. The first evidence of medieval faunal remains was recovered from the North Quarter and it shows that pigs gradually decrease in frequency from the Roman military phase to the end of the 18^{th} century, though with the exception of the first half of the Saxo-Norman period when they were present in their highest frequencies, matching their frequency in the Roman military phase which is higher than the average for the geographical area (Rippon 2012, Table 12.2). One possible explanation for this could be the disruption after the end of the Roman Empire. Meat supply of cattle and caprine may not have been reliable as it requires planning ahead to sustain the herds as well as maintaining contacts with the farmers for them to transport animals to towns which may not have been an easy feat after the collapse of the Empire. This is evidenced by the absence of Early Medieval (phase 4) finds from Exeter - people still lived in the town, but it was a much reduced population and a very different way of life compared to earlier and later periods. One way of ensuring a meat supply for a family is to keep pigs. They are easy to rear, grow fast, and can be kept in a pen living of scraps or part-managed in woodland ensuring a reliable meat supply with no need for relying on other people for food which makes them an excellent risk management strategy in an unstable society.

Pig numbers then drop again after the Norman Conquest ($p = 0.0188$) and continue to decline until the end of the 18^{th} century. When looking at the North and West Quarters separately (Figure 8.3 and 8.4), there are some differences in the proportions of pigs. In the North Quarter, the decline in pig numbers start after phase 5, but evens out after phase 8, while in the West Quarter the continuous decline does not start until after phase

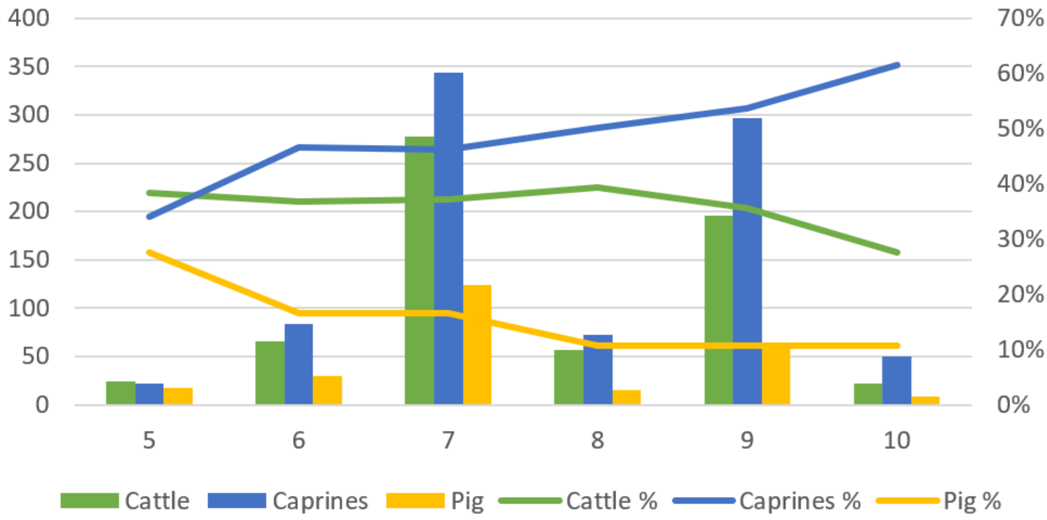


FIGURE 8.3: MAU from the North Quarter of major livestock species by absolute numbers and percent

8. It should also be noted that pigs are generally more frequent in the North Quarter than in the West.

Cattle, in general, remain steady in numbers throughout the medieval phases but are more frequent in the West Quarter than the North Quarter. Unfortunately, the medieval sample sizes from the South Quarter are very small, and therefore may not be accurate, though they do suggest that in the southernmost area of the city, cattle were much more frequent during the High Middle Ages than anywhere else in Exeter (Figure 4.58). Caprines in general increase slowly in frequency over the medieval period (Figure 8.1), yet once again there are differences between the North and West Quarters, with caprines in the North Quarter being the most numerous livestock species from the Norman Conquest onwards, whereas in the West Quarter there is little change in proportions from phase 6 to 8 so cattle and caprines occur in equal numbers throughout the medieval period. It should be kept in mind that cattle are the largest of the three species, so a carcass contains a larger quantity of meat compared to a sheep or pig, and they are therefore highly likely to have supplied the majority of the meat to medieval Exeter even though caprines are more numerous in some parts of the city.

Material from extramural sites suggest that the livestock species occur in noticeably different proportions in sites outside of the city wall. In the High Medieval material from

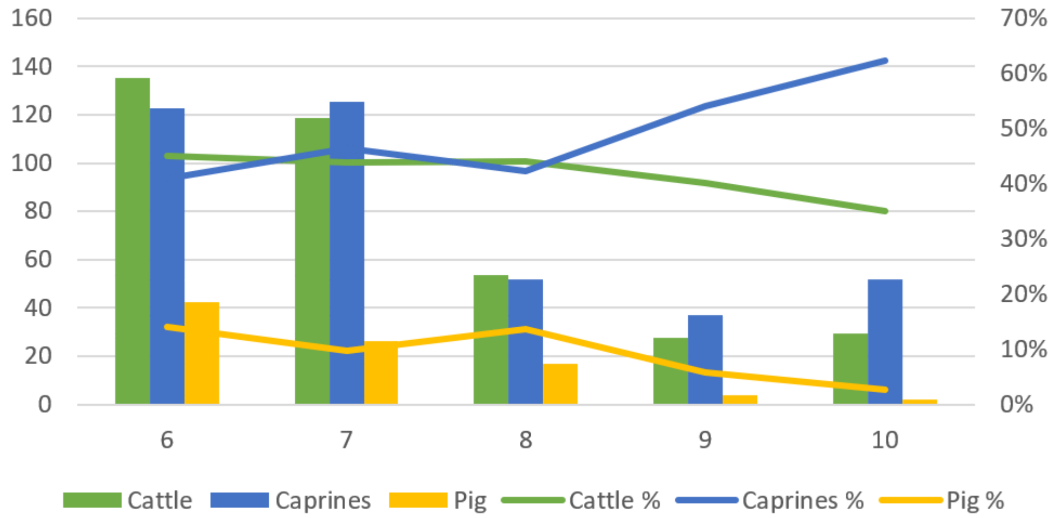


FIGURE 8.4: MAU from the North Quarter of major livestock species by absolute numbers and percent

Acorn Roundabout, cattle represent 60% of the total livestock MAU and caprines represent 26% (Table 4.6). This pattern is more similar to Roman civil times and contemporary material from the South Quarter than any of the medieval phases from the North and West Quarters, though there is no immediate explanation for this difference. The material from this site is likely to be from a high-status household living on a tenement based on the excavation notes and the game species identified amongst the faunal remains (Table 4.5). The social status represented by the material is unlikely to be the cause as material from the North Quarter does not have the same high proportion of cattle, and the similarity in proportions to the South Quarter, which is primarily low status or industrial material, further highlights that status is unlikely to be the determining factor. The discrepancy may therefore simply be a result of the preference of the individual household, or different social factors influencing the choice of meat on either side of the city wall.

Maltby's analysis of medieval faunal material covers the North Quarter alone and showed little contemporary difference within the sites analysed from this area and the proportions for the livestock species are very similar to those from this study shown in Figure 8.3 (Maltby 1979, Figure 2). Levitan's analyses of the extramural sites Exe Bridges and St. Katherine's Priory do not provide proportions for comparison yet they are still useful for highlighting variation within and between sites such as the presence of industrial horn processing outside the southwestern city walls (Levitan 1989).

TABLE 8.2: Proportions of major livestock species at Princesshay. Source: Coles *forthcoming*

	Early medieval/Saxo-Norman	Middle medieval	Late medieval
Cattle	47%	46%	50%
Caprines	38%	40%	39%
Pig	15%	14%	11%

Recent analysis of the medieval deposits from Princesshay (East Quarter) provides a good comparison for the second half of the Saxo-Norman period and the High Middle Ages ecclesiastic material from the West Quarter (phase 6 and 7). The middle and late medieval material from Princesshay (Table 8.2) comes from a Dominican Friary and shows that the proportion of caprines in the diet is stable over time while cattle increase, and pigs decrease. Cattle are the most frequent at all times followed by caprines and lastly pig, though the numbers are biased towards cattle as the proportions are based on NISP and thereby influenced by animal size and the number of fragments it can break into, so in reality, cattle and caprines probably occurred in fairly equal numbers in this friary until the late medieval phase when cattle become increasingly more frequent. When compared to the West Quarter, it shows that the monastic diets in Exeter had both similarities and differences depending on what medieval phase we look at. This is hardly surprising as there were different dietary restrictions within the various monastic orders which will be discussed further below.

The general medieval proportions of livestock occurring in various cities across England (Figure 2.9) show how diverse the exploitation patterns are. As the material from Exeter demonstrates, patterns change over time and differ within individual cities and between cities. The differences between cities do not appear to be based on geographical locations, so the most likely determining factor is local or regional preference for either beef, mutton, or pork. As the extramural sites in Exeter and Southampton show, there can even be great variation within a single city. This could be influenced by social status, yet, at least in Exeter, there is no obvious evidence for it, so while there may be regional preference for certain meats, there also appears to be site specific preferences, or at least this is tempting to assume. In reality the livestock proportions were likely to be influenced by a whole range of factors, such as social status, industries as seen in the post-medieval period, the local geography and whether it is coastal, highland, lowland and so forth, as well as a whole host of less obvious influences, yet to untangle these broad trends using only faunal material, and particularly general proportions, is next to impossible. Large-scale interdisciplinary studies have the potential to give insight into complex research questions, yet all is not lost to the 'future research' category for smaller faunal studies, there are still certain, easy to gather, types of data that can tell us about social aspects of past lives such as presence/absence of species.

The high-status diet

Similar to the Roman period, the presence of non-livestock species is rather useful when looking at the social groups represented in Exeter, particularly when studying the medieval period. Some of the sumptuary laws restricted access to game species, meaning that only the nobility or the very wealthy had access to these meats. While game never contributes large quantities of meat to the diet in medieval Exeter, it is still a significant addition in terms of social implications. Table 8.3 gives an overview of the presence of game species in Exeter and as the total NISP of a phase and quarter will affect the number of identified status-indicator species, the proportion of game species out of the total number of identified species is listed in Table 8.4 and 8.5. Based on this information, in the medieval, and probably post-medieval, period an area is highly likely to primarily have high-status households if the game species proportion is above 20%, though it is still important to look at the individual species to determine the nature of the households. With this in mind it becomes clear that the high-status population of Exeter primarily lived in the North Quarter from the second half of the Saxo-Norman period to the first half of the post-medieval period (from phase 6-9), as there is much higher number of game species and other high-status species indicators such as woodcock, hawk, and grey heron (Table 8.3, 8.4 and 8.5). As mentioned in previous chapters, the material from the High Middle Ages in the West Quarter is from a high-status tenement, and the presence of five of these species confirms the interpretation of the household belonging to the upper echelons on society. Particularly, the find of 23 hawk specimens (MNI: 3) is interesting as hunting with birds of prey, which is one of the only ways these specimens can be explained, is limited to the elite. Finding them, and roe deer, is a very strong indicator that, at least for a while during the Late Middle Ages, a high-status household occupied a tenement on modern day Friernhay Street.

The monastic diet

In contrast to the high-status phases and areas, the phase 6 and 7 material from the West Quarter, which was excavated from monastic sites, has two deer species in phase 6 and none in phase 7 showing the scarcity of game species in the ecclesiastic diet. Monks were prohibited from eating meat unless ill, but over the course of the 12^{th} century meat was first allowed to those dining with the abbot in private, next, in a designated separate room for those in poor health, and finally, though still in a separate room, to all monks during certain periods of 'recreation' over the course of the year (Burton 1994, 166; Harvey 2006, 220; Knowles 1963, 462). The bending of the dietary rules is very evident in Exeter where game meat, in small quantities, was consumed alongside that of the usual livestock, at least in the latter half of the Saxo-Norman period (Table 8.3). The presence of game, and not just livestock, may suggest some connections to wealthy citizens. The minimal differences in the proportions of livestock between the monastic and high-status material indicates that the diets were fairly similar, though the ecclesiastics ate more cattle and less caprines than the North Quarter population. Furthermore, the fracture studies presented in chapter 6 show that marrow consumption was different with the monastic diet containing more caprine marrow and very little pig marrow (Figure 6.4). There is also some evidence for the monasteries receiving less 'meaty' parts such as the tibia and radius of the carcass compared to the North Quarter (Figure 5.15).

Unfortunately, no further information is available on the variety of species in the monastic diets in Exeter but looking elsewhere similar trends are apparent. At Merton Priory, in the vicinity of medieval London, a large quantity of faunal remains was recovered from the infirmary complex and the guest hall with the majority being identified as cattle, capine, pig, and chicken alongside smaller quantities of game which include heron, swan, wild duck, partridge, woodcock, brown hare, and venison (Wright 2010, 58). Like in Exeter, this shows the close similarity to the diet of the upper echelons of

TABLE 8.3: Overall NISP by phase and quarter from this study

				5	6		7		8		9		10	
	1	2	3	N	N	W	N	W	N	W	N	W	N	W
Cattle	133	1060	61	36	104	246	498	212	115	120	376	46	53	70
Sheep/goat	81	409	28	22	116	188	485	158	124	79	402	46	58	79
Pig	88	284	25	23	46	67	188	42	28	24	94	7	12	5
Cat	1	1		6	6	1	35	1	13	19	15		2	
Dog	16	42	9		1	1	16	1	8	8	8	1	3	
Roe deer		3		1		1	3			1	2		1	
Fallow deer									3		3		1	
Red deer	14	10	1		1	2	1							
Rabbit					3		1			1	21		5	2
Hare		2					4		1		2			
Wild boar cf.	3													
Horse	11	38	6		1	4	16	5	8	4	14		1	
Badger		1												
Pine marten					1									
Hedgehog											1			
Mole											1			
Rat										7	8			
Rat cf.										2	1			
Common lobster					1				1					
Small mammal		3		1			24		5		23	16		
Medium mammal	19	112	6	22	63	24	235	27	23	27	207	8	13	21
Large mammal	20	62	8	12	48	30	170	28	18	9	136	9	5	10
Domestic fowl	11	52	6	6	30	4	116	8	28	132	127			1
Domestic fowl cf.				1	2		9		1		38			
Goose		2		2	3		18	3	3	9	18		1	1
Goose cf.									1		1			
Mallard							2		1		4	1		1
Mallard cf.		2												
Teal		1												
Shoveler										1				
Duck		1												
Raven		4			1		15				1			
Crow							1							
Cormorant											1			1
Eider		1												
Grey heron									1					
Gull											1			
Hawk										23				
Lapwing							2							
Pigeon/dove							1			3				
Red grouse							1							
Thrush											2			
Turkey											4			
woodcock	1	4		2					2		4			
Woodcock cf.							1		1		2			
Bird of prey											1			
Medium bird										1				
Bird										2	10			
Total NISP	398	2094	150	134	427	568	1842	485	385	472	1528	134	155	191

TABLE 8.4: Numbers and proportions of game species in the Roman period from this study

Phase	1	2	3
No. of game species	*3*	*8*	*1*
Proportion of total number of species	27.2%	38.1%	11.1%

TABLE 8.5: Numbers and proportions of game species in the medieval and post-medieval periods from this study

Phase	5	6		7		8		9		10	
Quarter	N	N	W	N	W	N	W	N	W	N	W
No. of game species	*2*	*2*	*2*	*9*	*0*	*6*	*5*	*11*	*1*	*3*	*3*
Proportion of total number of species	16.7%	12.5%	18.2%	39.1%	0%	30%	26%	35.5%	12.5%	25%	30%

society, though on the continent the diet was more restricted. In a review of a number of Belgian sites, it is apparent that large game is always absent, and pig is extremely rare (Ervynck 2006, 217). When studying monastic contexts, it is important to remember that there was a number of orders, each with their own rules, so differences in diet are to be expected between sites and orders. Furthermore, fish is much more prevalent in ecclesiastic diets and secular ones, so any studies should include fish and sieving should be a priority in any new excavation.

The urban industry/craft activities

The interpretation of the South Quarter, at least the area the Mermaid Yard excavations cover, was assumed to be an industrial or craft area based on archaeological findings and previous and current analyses. This interpretation may need to be revised slightly as the presence of red deer (a complete humerus) and fallow deer (a partial metatarsal) in a single context from the High Middle Ages could indicate that it was not entirely low-status (Table 4.58). There is no evidence that meat on the humerus was consumed or that the metatarsal was used for craft purposes, so we cannot determine why these specimens were located in the area. As the specimens were located in the same context it seems more likely that a household had on a rare occasion access to game, though whether the game was obtained by legal means will remain unknown.

The skeletal part abundances with the relatively high numbers of low utility elements still support primary butchery going on in the area, but as mentioned in Chapter 5, this is not contained to the South Quarter, but occurs in almost all areas and phases. What the skeletal part abundances and presence of game species underline is that there is never a single function or social status of an area, it is always a mix which makes general interpretations difficult and sometimes even contradictory to the more detailed picture. This is further highlighted by Levitan's (1989) analysis of the Exe Bridge material with its large deposits of horncores likely from a nearby horn worker (Levitan 1989, Table 2). These deposits are, rightly so, interpreted as industrial waste, yet they are still mixed with high meat utility elements showing the mixed nature of the deposits.

8.4 The post-medieval period

The transition from the late medieval phase to the post-medieval period heralds some clear changes in the exploitation of livestock. Across both the North and West Quarters caprines become increasingly more frequent while cattle decline in representation (Figure 8.3 and 8.4), and further changes are also reflected in the metrical analysis (Chapter 7; Figure 8.6, 8.7, 8.8). The log-ratios show a marked increase in caprine breadth measurements suggesting development of existing types or import of new ones simultaneously with a shift in herd structure consistent with management for wool (Table 8.1). This development is in line with our knowledge of the importance of the wool industry in Exeter which had been growing since the 14^{th} century when the MAUs show caprines to be increasing in numbers (Figure 8.1). The 16^{th} century (phase 9) changes are likely the reflection of the wool industry developing into an even bigger cloth manufacturing industry which likely impacted the settlements surrounding Exeter (Gray 2001).

As mentioned previously, there is a distinct lack of urban post-medieval faunal material in the cities referred to in this thesis. This trend can also be seen in Exeter through the much smaller quantity of recovered material compared to the high and late medieval periods, even though logic dictates that more material should be deposited in this period as a result of the growing population. Furthermore, apart from the increasing reliance on caprines in the diet, there are no signs of any industrial or craft activity such as primary butchery or horn and leather working though this is highly unlikely to be a

TABLE 8.6: Summary of cattle breadth log ratios from Chapter 7

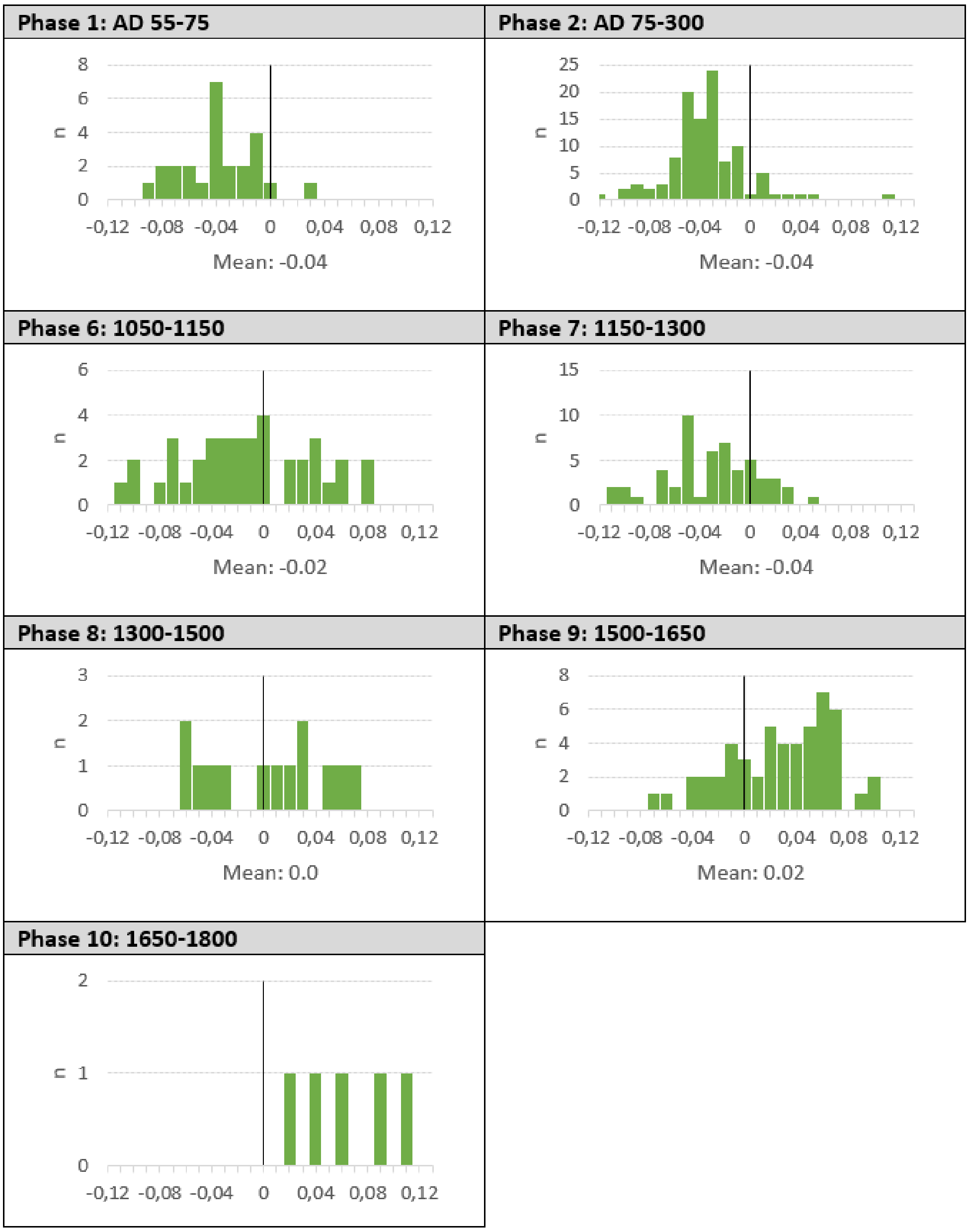


TABLE 8.7: Summary of caprine breadth log ratios from Chapter 7

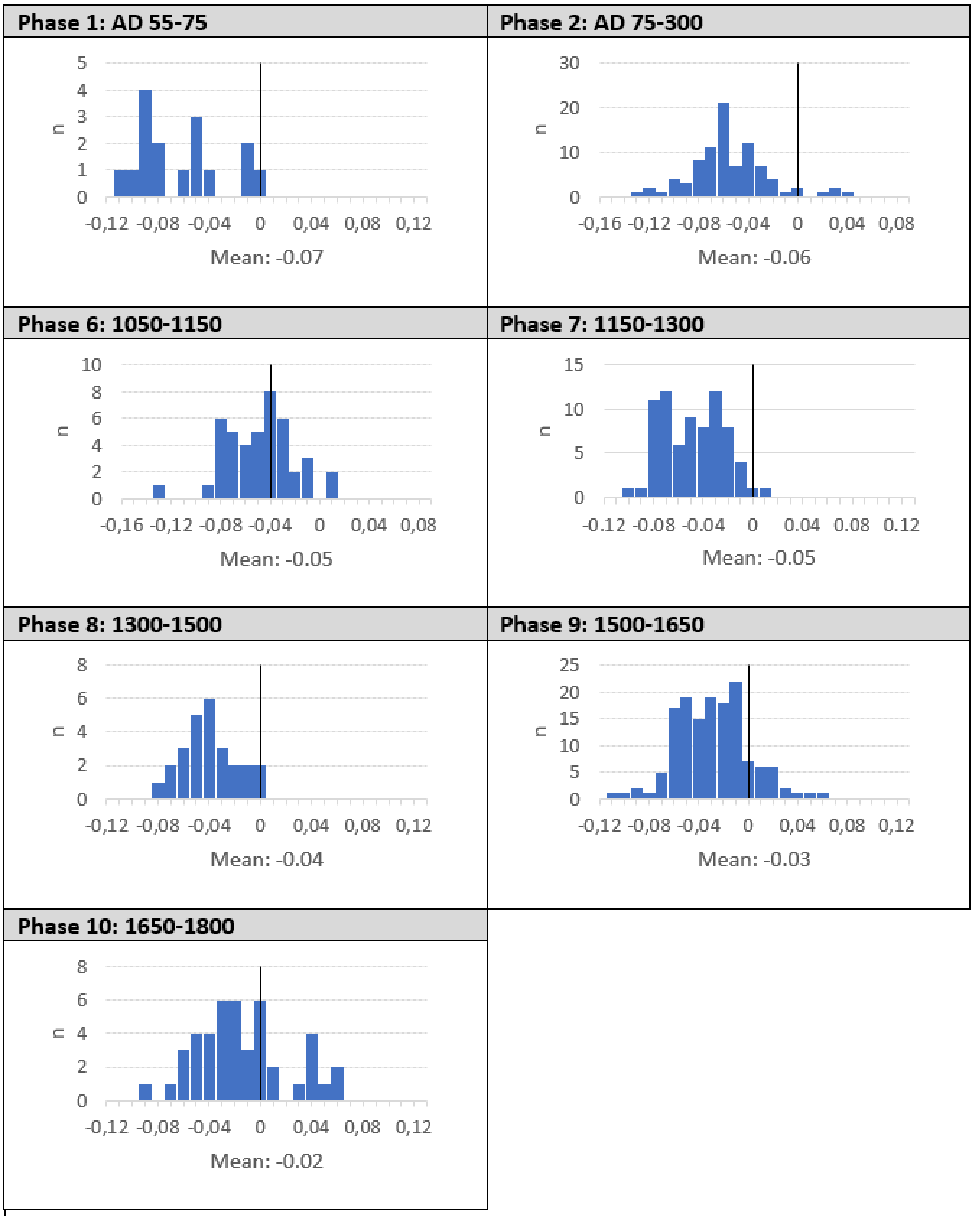
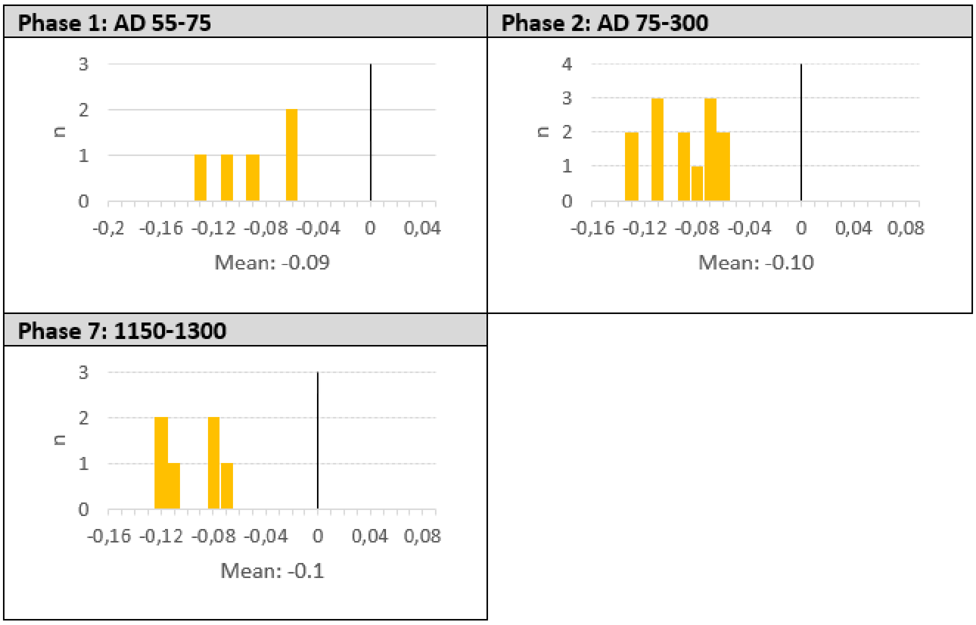


TABLE 8.8: Summary of pig breadth log ratios from Chapter 7



reflection of the true situation. Historic evidence shows industrial works in Exeter being located in close vicinity to the River Exe and the Quay, so it is not much of a stretch of the imagination to suggest that the waste was being dumped in or near the river. Very few excavations have been undertaken in this area of Exeter, but one of these excavations at Shooting March Stile revealed large post-medieval deposits of cattle horncores suggestive of a nearby horn worker which further supports the assumption of industry and waste disposal in the river area. The scarcity of post-medieval faunal remains outside of the North Quarter could be explained partly by disposal techniques similar to the industrial works and partly by truncation of the deposits by Victorian and later construction phases which has been noted in the majority of excavation reports from Exeter.

The high-status diet

Hunting is still perceived to be an elite pastime in 21st century England, so it is not much of a stretch to imagine that this concept was born in the middle ages and has persisted into current times and is therefore also applicable to post-medieval faunal material, even though it was no longer enforced by law.

FIGURE 8.5: Turkey specimens from Paul Street excavations dated to 1520-1550

The most substantial evidence for wealth and connections of an individual household in Exeter is the presence of three turkey bones in a context dated to 1520-1550 (Figure 8.5). Turkeys are not native to England or continental Europe but rather to North America. The date of the turkey's first appearance in Europe is unknown, but written documents suggest a 1511–12 introduction to Spain and 1520 in Italy (Crawford 1992; Fothergill 2014). Their introduction to England is credited to William Strickland, who claimed to have bought six turkeys from Native American traders and sold them in Bristol in 1524 or 1526. Until recently, there were no archaeological finds to support a 1520s introduction, as the earliest closely dated physical remains were from a 1534–50 context at St Alban's Abbey (Hertfordshire) and almost all other finds have broad date ranges (Poole 2010; Fothergill 2014). Fothergill (2012) suggests that when turkeys were initially introduced to Europe their status as exotic animals meant that they were more likely to be used for display purposes rather than food. However, these three bones from Exeter tell a slightly different story.

The specimens were recovered from the Paul Street material (North Quarter) and consist of two femora and an ulna that appear to be from the same individual. They were recovered from a context containing the remnants of what is likely a high-status feast. This interpretation is supported by the presence of high-quality imported ceramics and glass which were tightly dated to 1520–1550 and are indicative of elite feasting activities. This timing overlaps with the proposed introduction date suggesting that this bird was likely amongst the first turkeys seen in Britain, and fine cut marks across the surface

TABLE 8.9: Numbers and proportions of birds in the Roman period

	1	2	3
All bird	3%	3%	4%
Chicken	3%	2%	4%
Goose	-	-	-

of all three specimens suggest that this particular turkey was eaten, making it among the earliest recorded evidence for turkey consumption in England. This evidence shows that this bird was not kept purely for display purposes. It is impossible to tell from the archaeological material whether it was on display for a period of time, though it was associated with a tenement rather than a manor house with large grounds suitable for the showing of animals, so unless it was kept inside the house for showing off to guests, it seems unlikely that it was kept alive for long. Nonetheless, the consumption of it may have been an even greater display of wealth than the keeping of a live bird as eating an exotic and rare animal at a feast is a clear sign of disposable wealth. The household was likely showing off its international connections at this event, and probably others too, as associated contexts held the remains of other imported glass and ceramics from the Netherlands, Spain, Northern Europe, and Venice. Finds such as these show just how well-connected and wealthy Exeter was in the 16^{th} century, though to study this from a faunal perspective we need to look at the presence of individual species such as the turkey, even if they occur in very small numbers, as they can often provide us with finer detail about past lives compared to broader studies of livestock.

The material from St. Nicholas' Priory, a Tudor manor house in the West Quarter, provides a contemporary comparison for the material from the North Quarter. Here six game species are represented, making up 1.2% of the total faunal and avian NISP and 30% of the total number of identified species (Levitan 1989, Table 7) which, following Table 8.4 and 8.5, confirms that it is a high-status household on par with those in the North Quarter.

TABLE 8.10: Numbers and proportions of birds in the medieval and post-medieval periods

	5	6			7			8			9			10	
	N	N	W	S	N	W	S	N	W	S	N	W	S	N	W
All bird	11%	11%	1%	7%	12%	3%	1%	11%	40%	4%	19%	1%	4%	1%	3%
Chicken	5%	7%	1%	7%	7%	2%	0.5%	8%	28%	-	11%	-	2%	-	1%
Goose	1%	1%	-	-	1%	1%	0.5%	1%	2%	4%	1%	-	2%	1%	1%

8.5 Birds

Some words should be set aside for the other birds in Exeter. They have not been given any attention in the previous chapters, though they could be a full study in their own right. The game and imported species and their social significance are noted above so this section will mainly deal with chickens/domestic fowl and geese. Chickens are present in Exeter in all phases from the start of the Roman military settlement until the end of the 18^{th} century and typically make up over 50% of all bird specimens, only in a few areas have they not been identified (Table 8.9 and 8.10). The majority of geese identified here are probably domestic ones with some wild species among them. They are present in much smaller numbers than chickens in the medieval and post-medieval periods but have not been identified in Roman contexts in this study. Maltby has, however, noted the presence of some specimens in phases equivalent to phase 1, 2, and 3 here (Maltby 1979, Table 95), and Coles has similarly identified them in Roman contexts in Princesshay (Table 8.2). While their contribution in quantity of meat does not rival cattle, caprines, or pigs, their relatively large numbers and, potential, social implications show that birds are still an important part of the diet that should not be ignored. If we want to expand upon our understanding of life in Exeter throughout the last 2000 years studying birds, as well as fish which has not been included here, may be the way forward as the main livestock species have undergone extensive research by four separate zooarchaeologists while the less frequent species have received very little attention in comparison despite them holding a vast amount of information that is yet to be explored.

Chapter 9

Conclusions

This thesis set out expand and add detail to previous analyses of faunal material from Roman, medieval and, post-medieval Exeter. In order to do this, a list of research questions and aims were set and are as follows:

Research questions

1. What level of variation is there over time in animal representation and exploitation between contemporary sites in Exeter?

2. How do butchery practices develop in Exeter from the Roman occupation to the late 18th century?

3. Does a growing urban settlement impact the metrics of the main domesticated species?

Research aims

1. To record all unanalysed faunal assemblages from Exeter and, if time permits, re-record previously analysed assemblages.

2. To record the butchery evidence from each assemblage.

3. To record the types of fracture and levels of fragmentation from each assemblage.

4. To record taphonomic modifications to the assemblages.

5. To measure the long bones of the main livestock species.

All three questions were answered through the completion of the aims, though it was not possible to analyse any previously studied, but unpublished, assemblages. The analysis undertaken for this PhD thesis has added further detail to the previous studies performed by Maltby and Levitan. Where Maltby primarily studied material from high-status households and Levitan studied industrial material, this thesis has added to our understanding of the spatial variation in Exeter by comparing and contrasting food consumption within higher and lower status areas of Exeter, and between secular and monastic communities.

Maltby's description of the butchery techniques used for major livestock carcasses throughout the three periods remain the same, though the new data presented here have considerably moved back date for the use of sagittal splitting. In Maltby's material, which was primarily recovered from the North Quarter, sagittal splitting was uncommon before the post-medieval period but the new analysis reveals that the method was already in use in the Roman Civil phase in Exeter, though the evidence is limited to two specimens, one large mammal, likely cattle, and the other a medium mammal, likely sheep. The technique goes out of use again until the late 12th or the 13th century and by the beginning of the post-medieval period it occurs on large numbers of vertebrae which is in accordance with Maltby's findings.

The detailed way for recording butchery marks employed during this project has allowed for a very comprehensive understanding of the various butchery techniques used throughout the Roman, medieval, and post-medieval periods in Exeter. While this recording method only allows for visual analyses of the patterns rather that quantitative ones, it uses free software, requires no specialist knowledge, and is very quick to do thereby not adding any materials cost to the analysis and only spends a bit more time per recording than typing presence/absence into a database. Using this method, or a more detailed version where the butchery marks are recorded on element specific illustrations, is highly recommended for any future faunal studies of any type as it makes data easy to share and lessens the need for long written descriptions which does not allow for the same level of detail as an illustration with the exact butchery locations and types on it.

Between contemporary material in the North, West, and South Quarters the archaeological excavations and other types of archaeological material revealed that the areas represented different aspects of urban society such as the high-status households, the ecclesiastics, and the lower status craft and industrial areas. This thesis determined that only some types of data gained from analysing the faunal material can differentiate between the these social groups, while others show minimal differences. Metrical analysis showed changes over larger times scales consistent with national agricultural developments and revealed broad trends in herd management practices though show few differences within the city itself. Butchery practices similarly show broad changes over time, but no contemporary differences within the urban setting while skeletal abundances can show, as a minimum, where the primary butchery occurs. The proportions of the livestock species do not appear to be related to the social groups, yet game and imported species are the most useful of all faunal data for the identification of high-status households in the medieval and post-medieval periods. Fracture studies and age profiles are useful in some instances as the former can identify ecclesiastic material due to their minimal exploitation of pig marrow and the latter can, in the post-medieval period, identify some high-status households as they have a relatively higher proportion of young animals in their meat supply. In terms of knowledge gained from age profiles, it is clear that the general society or the farmers prioritised the other animal products, in particular traction for cattle and wool for sheep, over supplying Exeter with meat which may be why this type of data, at least in the case of this city, is rarely useful for studying inter-area differences. Nonetheless, each of the methods employed and types of data studied for this PhD thesis are useful in their own right and have all added some detail to the past faunal studies of Exeter both on a local and national scale.

Prior to this study no detailed quantitative analysis of fractures had been undertaken on historic material and our understanding of the importance of marrow and bone fats in the past two millennia is still in its infancy. If we want to understand the full use of animal products in the past and how the uses vary throughout society, fracture studies are a key part of building that knowledge. In prehistoric material this type of analysis has identified periods of dietary stress driving people to heavy exploitation of bone grease (Outram 2001) as well as identifying the transition to milk/dairy product consumption in the Neolithic (Johnson *et al.* 2018). This method has the potential to identify similar dietary needs and transitions in the historic periods which may not otherwise be apparent through other faunal analyses.

All the faunal material analysed for this project comes from the stores of the Royal Albert Memorial Museum in Exeter and while it was not the intention of this study some thoughts have been raised on the use of archives and what we should and should not keep in them. Museum stores are often overfull and while we might want to keep everything that comes out of the ground, the limitations of storage space make it impossible. But what should we keep and what should we dispose of? Based on this study, only assemblages with good excavation reports and good dating are worth keeping. For historic material, contexts with dating specific only to a time period rather than a specific century or sub-period will not provide specific enough contextual information to allow for good interpretations of any data with an understanding of the drivers behind any patterns observed which can make interpretations unreliable or misleading. However, poorly dated and/or excavated material should not just be thrown away, it is still useful for teaching collections, and sometimes reference material, which can be very hard to come by especially for zooarchaeologists outside of academic departments.

Future work

With regards to standard faunal analyses no further ones are needed on high-status material from Exeter, though additional ecclesiastic, low status, and riverside material would be very interesting as only minimal amounts are available and have been studied to this date.

As mentioned previously, fracture studies have not been undertaken on historic material prior to this analysis. However it is a valuable source of fat which is exploited by the social groups in different quantities and ways in the various periods; therefore it needs to be studied in other settlement types and social groups to determine how this food source has been exploited in historic periods.

To support the metrical data, geometric morphometric analysis should be undertaken, particularly of sheep, to gain further understanding of the development of existing types in the areas and the introduction of new ones. In particular, it would be useful for testing the the potential introduction of new caprine stock in phase 9 to determine if there were indeed two different groups of caprines present in Exeter at one time, with the group in the North Quarter disappearing' or at least increasing to a similar size of the animals in the West and South Quarters by phase 10. Furthermore, if different groups were present it would be interesting to see if they are morphometrically similar to animals elsewhere in Britain or Europe so we can determine where new stock was introduced from. Isotopic studies are already happening, and when the results of these are published, they should be compared to the metrical data from this thesis, and any available geometric morphometric data.

Another interesting avenue to explore are isotopic analysis of the human remains from Exeter and see how the results compare to the faunal data.

Chapter 10

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Appendix A

Data collected by Maltby and Levitan

TABLE A.1: Key to Maltby's (1979) phases

Roman	Phase	Time span
	R1	AD 55-75
	R2	AD 75-100
	R3	AD 55-100
	R4	AD 75-150
	R5	100-200
	R6	200-300
	R7	100-300
	R8	300+
	R9	Undated Roman
Medieval	**Phase**	**Time span**
	Md1	1000-1150
	Md2	1100-1200
	Md3	1000-1200
	Md4	1150-1250
	Md5	1200-1250
	Md6	1250-1300
	Md7	1200-1300
	Md8	1250-1350
	Md9	1300-1350
	Md10	1350-1500
Post-medieval	**Phase**	**Time span**
	Pm1	1500-1600
	Pm2	1550-1650
	Pm3	1660-1700
	Pm4	1660-1800

TABLE A.2: Key to Maltby's (1979) site codes

Code	Site name
BS	Bartholomew St.
CC/MM	Cathedral Close/ St. Mary Major
GS I-III	Goldsmith St. Areas I-III
HL	Holloway St.
HS	High St.
RS	Rack St.
TS	Trickhay St.
VS	The Valiant Soldier site, Holloway St.

TABLE A.3: Summary of Maltby's (1979) Roman data

R1	GS	%	TS	%	MM/CC	%	RS
Cattle	307	*45,48*	61	*34,66*	119	*29,53*	10
Sheep/goat	194	*28,74*	66	*37,50*	125	*31,02*	3
Pig	127	*18,81*	40	*22,73*	109	*27,05*	0
Bird	47	*6,96*	9	*5,11*	50	*12,41*	0
Total	675	*100*	176	*100*	403	*100*	13

R2	GS	%	TS	%	MM/CC	%	RS	%	HL
Cattle	76	*27,74*	33	*28,70*	143	*26,88*	754	*78,13*	2
Sheep/goat	89	*32,48*	37	*32,17*	172	*32,33*	157	*16,27*	0
Pig	75	*27,37*	37	*32,17*	194	*36,47*	51	*5,28*	1
Bird	34	*12,41*	8	*6,96*	23	*4,32*	3	*0,31*	0
Total	274	*100*	115	*100*	532	*100*	965	*100*	3

R5	GS	%	TS	%	MM/CC	%	RS	HS	HL	BS
Cattle	245	*28,86*	102	*45,95*	126	*27,33*	31	55	57	89
Sheep/goat	311	*36,63*	68	*30,63*	169	*36,66*	24	20	9	14
Pig	236	*27,80*	41	*18,47*	148	*32,10*	5	11	2	4
Bird	57	*6,71*	11	*4,95*	18	*3,90*	2	2	0	1
Total	849	*100*	222	*100*	461	*100*	62	88	68	108

R6	TS	%	MM/CC	%	RS	HL	BS	HS
Cattle	35	*26,32*	163	*36,63*	25	3	5	4
Sheep/goat	37	*27,82*	107	*24,04*	8	0	0	0
Pig	33	*24,81*	143	*32,13*	3	1	0	0
Bird	28	*21,05*	32	*7,19*	2	1	0	0
Total	133	*100*	445	*100*	38	5	5	4

R8	GS	%	TS	%	MM/CC	%	RS	%
Cattle	808	*50,06*	589	*67,78*	140	*48,11*	66	*52,38*
Sheep/goat	375	*23,23*	97	*11,16*	43	*14,78*	33	*26,19*
Pig	290	*17,97*	138	*15,88*	85	*29,21*	21	*16,67*
Bird	141	*8,74*	45	*5,18*	23	*7,90*	6	*4,76*
Total	1614	*100*	869	*100*	291	*100*	126	*100*

	RS-R3	**HL-R3**	**TS-R4**	**RS-R7**	**GS-R9**
Cattle	8	6	11	44	249
Sheep/goat	2	5	6	13	157
Pig	4	5	14	7	67
Bird	0	0	2	0	38
Total	14	16	33	64	511

TABLE A.4: Summary of Maltby's (1979) medieval data, phase Md1-Md6

Md1	GS I-II	%	GS III	%	TS	%	HS
Cattle	320	*42,22*	415	*42,13*	379	*39,64*	39
Sheep/goat	265	*34,96*	326	*33,10*	289	*30,23*	13
Pig	113	*14,91*	161	*16,35*	153	*16,00*	18
Bird	60	*7,92*	83	*8,43*	135	*14,12*	5
Total	758	*100*	985	*100*	956	*100*	75

Md2	GS I-II	%	GS III	%	TS	%	HS	%
Cattle	753	*33,08*	940	*37,68*	349	*42,72*	66	*46,15*
Sheep/goat	1005	*44,16*	979	*39,24*	292	*35,74*	44	*30,77*
Pig	267	*11,73*	371	*14,87*	101	*12,36*	24	*16,78*
Bird	251	*11,03*	205	*8,22*	75	*9,18*	9	*6,29*
Total	2276	*100*	2495	*100*	817	*100*	143	*100*

Md3	GS I-II	%	GS III	%	TS	%
Cattle	160	*28,83*	180	*27,27*	93	*36,33*
Sheep/goat	279	*50,27*	300	*45,45*	102	*39,84*
Pig	63	*11,35*	105	*15,91*	41	*16,02*
Bird	53	*9,55*	75	*11,36*	20	*7,81*
Total	555	*100*	660	*100*	256	*100*

Md4	GS I-II	GS III	%	TS
Cattle	24	83	34,73	7
Sheep/goat	37	71	29,71	16
Pig	8	46	19,25	5
Bird	9	39	16,32	3
Total	78	239	100	31

Md5	GS I-II	%	GS III	%	HS
Cattle	57	*27,67*	182	*31,38*	18
Sheep/goat	105	*50,97*	218	*37,59*	26
Pig	23	*11,17*	104	*17,93*	8
Bird	21	*10,19*	76	*13,10*	7
Total	206	*100*	580	*100*	59

Md6	GS I-II	%	GS III	%	TS	%
Cattle	368	*37,32*	966	*34,01*	283	*35,46*
Sheep/goat	405	*41,08*	1115	*39,26*	325	*40,73*
Pig	88	*8,92*	408	*14,37*	88	*11,03*
Bird	125	*12,68*	351	*12,36*	102	*12,78*
Total	986	*100*	2840	*100*	798	*100*

TABLE A.5: Summary of Maltby's (1979) medieval data, phase Md7-Md10

Md7	GS III
Cattle	14
Sheep/goat	19
Pig	14
Bird	1
Total	48

Md8	GS I-II	%	GS III	%
Cattle	106	*29,44*	43	*34,13*
Sheep/goat	191	*53,06*	51	*40,48*
Pig	35	*9,72*	21	*16,67*
Bird	28	*7,78*	11	*8,73*
Total	360	*100*	126	*100*

Md9	GS I-II	%	GS III	%	TS	%
Cattle	253	*46,42*	33	*18,64*	131	*33,76*
Sheep/goat	196	*35,96*	83	*46,89*	137	*35,31*
Pig	51	*9,36*	35	*19,77*	38	*9,79*
Bird	45	*8,26*	26	*14,69*	82	*21,13*
Total	545	*100*	177	*100*	388	*100*

Md10	GS I-II	%	GS III	TS	%
Cattle	77	*38,12*	0	35	*25,93*
Sheep/goat	87	*43,07*	1	45	*33,33*
Pig	19	*9,41*	1	17	*12,59*
Bird	19	*9,41*	0	38	*28,15*
Total	202	*100*	2	135	*100*

TABLE A.6: Summary of Maltby's (1979) post-medieval data

Pm1	GS I-II	%	GS III	%	TS
Cattle	610	*40,32*	552	*21,37*	17
Sheep/goat	662	*43,75*	867	*33,57*	13
Pig	121	*8,00*	237	*9,18*	5
Bird	120	*7,93*	927	*35,89*	14
Total	1513	*100*	2583	*100*	49

Pm2	GS I-II	%	GS III	TS	%
Cattle	67	*39,18*	6	39	*17,65*
Sheep/goat	90	*52,63*	10	45	*20,36*
Pig	8	*4,68*	3	8	*3,62*
Bird	6	*3,51*	6	129	*58,37*
Total	171	*100*	25	221	*100*

Pm3	GS I-II	%	TS	%	VS	%
Cattle	223	*36,14*	175	*23,78*	22	*18,97*
Sheep/goat	307	*49,76*	203	*27,58*	73	*62,93*
Pig	43	*6,97*	38	*5,16*	4	*3,45*
Bird	44	*7,13*	320	*43,48*	17	*14,66*
Total	617	*100*	736	*100*	116	*100*

Pm4	GS I-II	%	GS III	%	TS
Cattle	350	*33,75*	85	*31,48*	10
Sheep/goat	502	*48,41*	119	*44,07*	9
Pig	104	*10,03*	32	*11,85*	5
Bird	81	*7,81*	34	*12,59*	3
Total	1037	*100*	270	*100*	27

TABLE A.7: Summary of Levitan's (1989) data from St. Katherine's Priory

	13c	%	14c	%	15c	%	16c	%
Cattle	342	*30,78*	334	*37,66*	313	*48,30*	3849	*67,37*
Sheep/goat	546	*49,14*	333	*37,54*	247	*38,12*	1334	*23,35*
Pig	111	*9,99*	87	*9,81*	45	*6,94*	405	*7,09*
Bird	112	*10,08*	133	*14,99*	43	*6,64*	125	*2,19*
Total	1111	*100*	887	*100*	648	*100*	5713	*100*

TABLE A.8: Summary of Levitan's (n.d. a) data from Exe Bridge

	13c	%	14c	%	15c	%	16c	%
Cattle	2760	*50,36*	451	*43,49*	511	*36,66*	612	*43,31*
Sheep/goat	2458	*44,85*	438	*42,24*	571	*40,96*	597	*42,25*
Pig	170	*3,10*	45	*4,34*	114	*8,18*	54	*3,82*
Bird	92	*1,68*	103	*9,93*	198	*14,20*	150	*10,62*
Total	5480	*100*	1037	*100*	1394	*100*	1413	*100*

TABLE A.9: Summary of Levitan's (1989) data from St. Nicholas' Priory

	1540-1570	%
Cattle	2256	*60,96*
Sheep/goat	1182	*31,94*
Pig	163	*4,40*
Bird	100	*2,70*
Total	3701	*100*

TABLE A.10: Summary of Maltby's (1979) Levitan's (1989, n.d. a) data

Roman	R1		-		R2		R3	R4	R5		R6		R7	R8	
	55-75	%	75+	%	75-100	%	55-100	75-150	100-200	%	200-300	%	100-300	300+	%
Cattle	805	40,88	1880	59,99	1008	53,36	14	11	705	37,92	235	37,30	44	1603	55,28
Sheep/goat	574	29,15	698	22,27	455	24,09	7	6	615	33,08	152	24,13	13	548	18,90
Pig	454	23,06	444	14,17	358	18,95	9	14	448	24,10	180	28,57	7	534	18,41
Bird	136	6,91	112	3,57	68	3,60	0	2	91	4,90	63	10,00	0	215	7,41
Total	1969	100	3134	100	1889	100	30	33	1859	100	630	100	64	2900	100

Medieval	Md1		Md2		Md3		Md4		Md5		Md6		Md7	
	1000-1150	%	1100-1200	%	1000-1200	%	1150-1250	%	1200-1250	%	1250-1300	%	1200-1300	%
Cattle	1153	41,56	2108	36,78	433	29,44	114	32,76	257	30,41	1617	34,97	3116	46,93
Sheep/goat	893	32,19	2320	40,48	681	46,30	124	35,63	349	41,30	1845	39,90	3023	45,53
Pig	445	16,04	763	13,31	209	14,21	59	16,95	135	15,98	584	12,63	295	4,44
Bird	283	10,20	540	9,42	148	10,06	51	14,66	104	12,31	578	12,50	205	3,09
Total	2774	100	5731	100	1471	100	348	100	845	100	4624	100	6639	100

Medieval	Md8		Md9		-		-	
	1250-1350	%	1300-1350	%	1300-1400	%	1400-1500	%
Cattle	149	30,66	417	37,57	785	40,80	824	40,35
Sheep/goat	242	49,79	416	37,48	771	40,07	818	40,06
Pig	56	11,52	124	11,17	132	6,86	159	7,79
Bird	39	8,02	153	13,78	236	12,27	241	11,80
Total	486	100	1110	100	1924	100	2042	100

Post-medieval	Pm1		Pm2		Pm3		Pm4	
	1500-1600	%	1550-1650	%	1660-1700	%	1660-1800	%
Cattle	7896	52,74	112	26,86	420	28,59	445	33,36
Sheep/goat	4655	31,09	145	34,77	583	39,69	630	47,23
Pig	985	6,58	19	4,56	85	5,79	141	10,57
Bird	1436	9,59	141	33,81	381	25,94	118	8,85
Total	14972	100	417	100	1469	100	1334	100